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The Marine Engineer

And Naval Architect.

LONDON, AUGUST 1, 1906.

IT has been decided that in order to make the Journal thoroughly representative of the scientific side of engineering as applied to marine work, that an addition be made to the title by joining that of "THE NAVAL ARCHITECT." It is hoped that by so doing we may enlist the interest and support of many who are more closely associated with naval architecture *per se* than the sister subject of marine engineering. The problems presenting themselves to the naval architect are often to be solved by a marine engineering answer, and *vice versa*, so that by the general interchange of ideas between two branches of the profession, progress may be made which would not be so under other circumstances. We have in the past very extensively treated many of the subjects dealt with in papers read at the meetings of the Institution of Naval Architects and kindred Societies, and by continuing this policy in the future we shall, no doubt, fill a want felt by many who, owing to non-membership of an institution, are debarred from a ready access to the funds of valuable knowledge contained in the transactions of such learned societies.

ATTENTION is once more called to the case of the failure of the copper steam pipe by the accident of the *Silurian*. There was an explosion aboard this ship on March 11th, 1906, when she was on a coasting voyage from Manchester to Cardiff, in ballast. A Board of Trade inquiry into the circumstances attending the accident followed, and the official report of what transpired has just been published. The *Silurian* is a comparatively new ship, having been built in the year 1898. She is classed by Lloyd's, whose surveyor had inspected the machinery some two years before the occurrence with which we are concerned. It appears that the steam pipe which failed was some 10 ft. long, with an internal diameter of 4½ in. It was solid drawn, and had been in the ship since she came out, never, so far as the evidence showed, having needed any repairs or attention. The *Silurian*, which, as we have said, was in ballast, encountered heavy weather as she proceeded round the coast, and it is stated that the vibration of the engines was remarked at the time. At 11.30 a.m., on March 11th, when the ship was off the Bishop Light, the chief engineer observed steam escaping from a crack near the neck of the flange which joined one end of the steam pipe to the engine stop valve. The engines were at once stopped, and the pressure of steam—which ordinarily stood at 160 lb.—was reduced. Examination showed that the crack was but 2 in. long, and appeared to be nothing more than a hair in the solid copper. So a mould was put round the injured part of the pipe, and a mass of white metal run over the damaged place and also round the neck of the flange. The whole was covered with asbestos cloth, and the engines restarted at reduced pressure. At 5 a.m., on the following day, the ship reached Cardiff roads, whence she took a tug to dock. Examination was again made, and it now appeared that the crack had extended to a length of 12 in., leaving but 3¼ in. of solid metal to carry the steam. The inspector considered that those in the engine-room were fortunate, indeed, that the pipe held, as, if the crack had gone further, loss of life or injury to person would very probably have resulted.

From these facts, several lessons may be deduced. In the first place, it would not appear that there was any defect in the material or workmanship of the copper. In the next, it would seem that the steam pipe of the *Silurian*, which ran in this single length from the main stop valve at the boiler to the engine stop valve, was fixed somewhat too rigidly, and thus it was exposed to strains which it should never have been called upon to endure. Further, its trials were rendered the more severe by the fact that the engines—which should have been rigidly attached to the fabric of the ship—were not able to withstand the test of heavy weather when the vessel was in ballast trip, and vibrated noticeably, thus putting serious strains, of a kind which it was not, of course, designed to bear, on the steampipe. The points thus referred to may well be borne in mind by those who design and fit marine engines. Again, whilst those in charge of the engines and bridge of the *Silurian* seem to have done what they thought best under the circumstances, they do not seem to have quite realised at the time the causes of the accident. They probably thought that the little flaw they observed in the pipe was due to some defect in the manufacture, and that if they prevented an escape from it they would have no further trouble. But, as the event proved, the failure was due to the undue strains put on the pipe, and, not appreciating these, the officers took no means to diminish them, with the result that they continued their effects till they very nearly wrecked the engine-room. If something could have been done to shore up the cylinders for the time being, it is probable that the crack would not have extended as it did. As it happened, the voyage fortunately terminated before disaster occurred. But it would be well for engineers to remember that it is desirable, where possible, for them to deal with the causes of failures, as well as to execute temporary repairs to their machinery.

FOR some time past little has been heard about dissatisfaction among naval engineer officers, but now it would appear from correspondence and articles in our

contemporaries that this subject is coming to the front again. We have written "dissatisfaction," but perhaps that is hardly the right word to express the feeling which we are told still exists in this branch of the Naval Service. The naval engineers, or those of them who are represented by certain writers in the Press, wish it to be known that they are apprehensive lest any failure on the part of the authorities to carry out promised reforms should give rise to a feeling inimical to that absolute sense of satisfaction which is essential to the efficiency of the Service as a whole. It is not that they are already dissatisfied but that they fear they may become so if the fulfilment of their hopes be too long deferred. This is not exactly what Mr. George Hepburn calls, with some characteristic and perhaps pardonable exaggeration, "a highly dangerous and critical condition"; but it is a condition which needs attention, examination, and consideration, or what we should term "a friendly lead" may develop into something of a less amicable nature. The loyalty of our naval engineers, like their professional capacity, has never been in doubt, and if they now in recognised manner hint where difficulties are likely to arise we may be certain that it is worth the while of the authorities to give heed to their warning.

The matter lies in a nutshell. When the new scheme of entry and training for naval officers was inaugurated certain promises were made tending to the removal of disabilities under which the engineer officers of the old style believed themselves to labour, coupled with the suggestion that in process of time "complete assimilation" must be arrived at, as a matter of necessity. The promises brought satisfaction mainly to the older officers, the suggestion to those more junior and more likely to find themselves serving with the new type of naval engineers. Unfortunately the fulfilment of some of the promises required Treasury sanction, and apparently this has hitherto been withheld; while the party of re-action has proclaimed so loudly its intention to reverse the policy of Lord Selborne, that, although it has no real effect upon the naval authorities, it has aroused fears among those less well-informed of the ability of the Admiralty to carry out the scheme to completion. In the circumstances it is, perhaps, only to be expected that signs of impatience should be exhibited both by those officers who feel that delay in the fulfilment of promises must mean that they personally will not profit by their accomplishment, and by those also who, being loyally anxious to co-operate in making the new scheme a success, believe that to insure this a condition precedent is the sense of permanency and that this will only be assured when all distinctions of title, rank, and authority are swept away. With regard to the increased pay it is unpardonable that the Treasury should be allowed to place further obstacles in the way of this long-promised concession, and it is to be hoped that before Parliament rises this matter will be brought to its attention and settled forthwith.

The other matters are on a different footing. Mr. D. B. Morison, a gentleman whose keen interest in the Navy generally, and in the engineering branch particularly, gives a special importance to his remarks, writes: "Personally, I am convinced that the engineers and engineering have no more ardent supporter than the creator of the new scheme of naval organisation . . . . and what is more, I feel assured that the vital importance of the developments advocated are fully appreciated by him, and will be granted at no distant date." This is, no doubt, true, but what naval engineers feel is that the less distant the date the better chance for the success of the new scheme. For two reasons—first, because the new type of young officers will have to rely upon the officers of the old type for their technical instruction, and numberless anomalies will arise if the latter are not given executive titles and authority; secondly, because until the present engineers receive combatant rank and titles they will always be the excuse for that reversion to the old state of things which the apostles of the reactionary party in the House of Commons and out of it are working to bring about. We do not believe that the naval service afloat would be found averse from "complete assimilation," the objectors to such a course probably being found in the retired lists and among the unemployed; but, even so, their opposition is not to be despised, and care must be taken not to play into their hands. From this point of view it would be perhaps as well if those who are in the confidence of the naval engineers expressed their willingness to wait for this consummation until the first of the new type midshipmen enters upon his service training. But it is only reasonable that in dress and title the distinctions which now exist should be removed without further delay, and that all real grievance concerning relative pay and similar matters should be inquired into and remedied at once.

THE SCREW PROPELLER.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., &c.

IN 1838, or twenty-six years after the *Comet* was set to work, the first sea-going screw steamer was commenced, and in 1839 was launched, by which time the number of steamers propelled by paddle-wheels had increased enormously, and during the year two paddle steamers had crossed the Atlantic, namely, the *Sirius*, from Liverpool, and the *Great Western*, from Bristol. Almost as many years were to elapse, however, before the supremacy of the screw as a propeller for ships of all kinds would be generally acknowledged. That Archimedes invented the screw is not disputed; but it is difficult to say who first suggested its use as a propelling agent for vessels. The admirers of James Watt point with pride to the fact that, in writing to a friend, he suggested the adoption of something as a propeller of which he made a very rough sketch and which, by an effort of the imagination, may be taken to represent a screw. Long before James Watt was born, the screw was being used

* For previous articles, see issues March 16th, 30th, May 4th, 25th, June 8th, 22nd, and July 6th.

to propel steamers in a curious way; for, between the years 1727 and 1731, among the machines approved by the French Academy was an arrangement whereby a screw or helical feather, turning on an axis in a frame, was submerged in a river and anchored, and to its end was connected a winch drum, about which the tow-rope of certain barges could be wound. The screw was sufficiently large for the force of the current to turn it round, and thus draw loaded barges up stream. In 1776 Bushnell, the American, who had invented a submarine vessel with which he proposed to blow the British Navy out of existence, had a screw fixed to the top of it, so as to raise the ship when sunk, and still another screw, fixed to the bow, to propel the ship longitudinally. In 1785 Joseph Bramah, the well-known engine maker of Piccadilly, took out a patent for propelling a ship with a wheel at the stern, having a large number of feathers or blades set at an angle, so as to form virtually a screw propeller. In 1794 William Littleton, of London, made a propeller having three feathers or continuous blades, fixed on a drum, and worked by means of an endless rope. He had a boat fitted with this propeller, which was tried in the old Greenland Dock, but the speed realised was only two miles per hour, probably due to the fact that the propeller had too much surface. John C. Stevens, in America, in 1804 made an attempt to propel a vessel by a propeller made on Bramah's principle, and was so far successful that he obtained a speed of 7 or 8 miles per hour; but, unfortunately, for want of steam, he could not keep this up, and as the failure was attributed to the screw, further experiments were dropped. Trevethick, the well-known Cornish inventor, seems to have gone into the question of screw propellers more closely than was usual with him, for he goes so far as to recommend, among other things, that the edge of the thread of the screw should make an angle of 30 deg. with the axis. He also suggested that it might work within a cylindrical casing, but states that generally it would be better to revolve in the open water. He suggested, further, that there might be one or more such worms or screws on each side of the vessel. To-day, nearly 100 years after, we find that the latest ships afloat are to be fitted with four screws. A French engineer, one Captain De Lisle, in 1823, proposed to the Minister of Marine the fitting of a propeller with five blades, set helically in a frame of bars, something like a paddle-wheel. The only use the French Government made of this proposal was as a pretext for evading Ericsson's patent later on. In 1825 the well-known inventor and engine builder, Jacob Perkins, proposed to place two propellers, one right-handed and one left-handed, working on the same axis at the stern of the ship, so that the shafts were well above the water line. These screws revolved in opposite directions, and propelled the vessel very much as do the blades of a tramp steamer when running in ballast. In Perkins's time, nothing came of this, but many years afterwards the system was used in an Irish canal for the propulsion of boats running on it. In 1825 a company was formed, with the object of propelling vessels with a particular gas engine, and the promoters offered a reward of 100 guineas for the best proposal for a propeller other than a paddle-wheel. The prize was awarded to Mr. Samuel Brown, whose idea was to fit a screw in the bow of the vessel, which was carried out, and a speed of 6 to 7 miles per hour obtained. Now, probably the bow is the worst place to fit a propeller of any kind; and, with the form of ship used in those days, it would be particularly bad. As a matter of fact, the engine was a failure, and the company came to grief; but the propeller was blamed quite as much as the engine. In 1829 William Church, of Birmingham, took out a patent for propelling ships, and he, too, adopted the system of helical blades, which De Lisle had recommended; but, like Jacob Perkins, he preferred to have two propellers, one in front of the other, one right-handed and the other left-handed, and consequently working in opposite directions. Bennett Woodcroft, whose name afterwards became so closely connected with the success of the screw propeller, took out a patent in 1832, in which he shows two screws, one on each side of the ship, and each consisting of a spiral feather coiled round the shaft, "in such form that the angle of inclination which the worm makes with the axis of the cylinder continuously decreases, and the pitch or distance between the coils or revolutions of the spiral continually increases throughout the whole length of the shaft or cylinder." This was the first enunciation of the principle of varying pitch, which has since that time been claimed by numerous inventors, and to which they are perfectly welcome now, as engineers are generally convinced that there is no advantage in this distortion. In his day, and ever since, this gentleman has always been known as "increasing pitch Woodcroft." The practical success of the screw propeller was, however, not due to a member of the engineering profession, neither was it, as is often the case, due to the inventive genius of a medical man. It was, in fact, a plain British farmer, of Hendon, in Middlesex, formerly of Suffolk, Francis Pettit Smith, who, in 1836, took out a patent for propulsion with a particular form of a screw, and to his energy and tenacity of purpose much of the credit is due for the practical success of screw propulsion at an

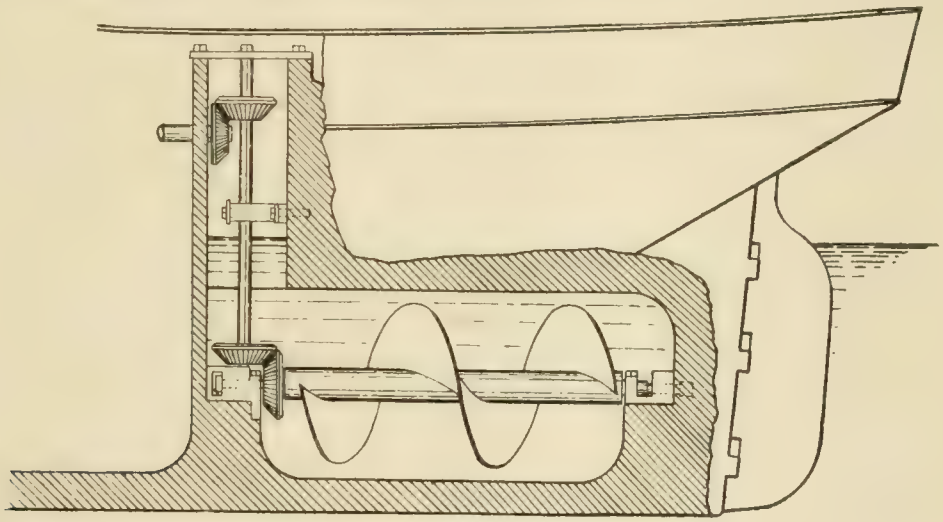


Fig. 6.

earlier date than might have been expected, knowing how strong a part prejudice plays in blocking the progress of something so entirely new as the screw propellor.

Before proceeding to deal with other patents, therefore, it will be interesting, as well as instructive, to follow the course pursued by Mr. Smith and his friends, inasmuch as the practical success and adoption of the screw as a marine propeller was more in consequence of what was done by them than perhaps any other cause; and, although the form of screw as used by Mr. Smith was not a good one, compared with those that came after, nevertheless, it served its purpose in its day. It was in 1835 that Mr. "Farmer" Smith, as he then was, had his attention called to screw propulsion. The following year he applied for, and had a patent granted him, and in effecting this he was fortunate enough to have excited the interest, and obtained the support of, a banker named Wright, for he was thus enabled to construct a small boat, practically only a model, with a screw made of wood, shaped as shown in Fig. 6, but with one turn only. The success with this model, however, was sufficient to warrant the adventurer and his supporters in building a larger boat, namely, of six tons burthen, into which an engine of about 6 H.P., having one cylinder, 6 in. diameter and 15-in. stroke, was fitted. The screw had two turns (*vide* Fig. 6), instead of one, as before, but still made of wood. It is interesting to note that it was in this boat that it was demonstrated that the screws could be much too long. It was tried at first in the Paddington Canal, and afterwards on the Thames during the spring and summer of 1837. On one of its trips in the canal the propeller struck some submerged object, and about half its length was carried away, to the dismay of those on board. Dismay, however, soon gave place to surprise when it was perceived that the ship was travelling at a much higher speed than before, and continued to do so; consequently the new screw was made with a single turn, which confirmed the previous rough experiment, as it gave much better results than the original one with two turns. In order to demonstrate the ability of this boat to steam in the open sea, Mr. Smith, in the autumn of 1837, navigated her from Blackwall to Ramsgate, and thence to Dover, where she was inspected by some Admiralty officials. A trial run was made between Hythe and Folkestone, which are five miles apart. This distance was covered in three-quarters of an hour, or at the rate of 6·67 miles per hour, after which she returned to London, in weather described as "stormy and boisterous," and her progress was watched with very great anxiety by those on the cliffs who were interested in her. It was, however, not until 1838 that the Lords of the Admiralty manifested any serious interest in this ship. They did so by asking to have special trials made under their inspection. These proved to be quite satisfactory, but the Admiralty, before deciding to adopt the screw for the public service, decided that an experiment should be made on a larger ship, say, of at least 200 tons. This, of course, was a very serious undertaking, especially for a man of Mr. Smith's position, and ought to have been carried out by the Admiralty; but his friends were so satisfied as to the ultimate success of the undertaking, that they found the necessary funds for its construction.

Messrs. Suter, Hartmann & Rahtjen's Composition Co., Limited, have sent us a list of some of the vessels coated by them during recent three months total, 2,646,520 tons.

Extra First-Class Engineers.—We have from time to time recorded the phenomenal successes from the City (late Leask's) Academy, of 4 and 5, High-street, London, and are pleased to be able to do so of those at the Extra Chief Examination held in London in July. The Leask Academy (Mr. A. E. Battle, Principal) presented five candidates, nine sitting in all; out of this five came the only four successes, three of whom had studied by correspondence and brushing up at the school—passing at first attempt.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

The Australian Mail Contract.

IT is much too soon for a comprehensive discussion of the details of the new arrangement just entered into between the Commonwealth Government and Sir James Laing's syndicate for the conveyance of the fortnightly mails after the termination of their present arrangement with the Orient Line. Almost every detail seems obscure. One authority states that the payment is to be calculated at the rate of £125,000 per annum, another says the figure will work out at something much nearer a quarter of a million sterling. There are discrepancies as to the rights of the company in the event of further Commonwealth legislation making the position of the contractors more difficult than at present. One telegram says they are to have the right of abandoning the contract, whilst another suggests that, in such an event, the Government will take the fleet over, and that on terms favourable to the company. Whilst, therefore, we must keep our general discussion of the matter till the mail brings full details, there seems to be one or two matters on which there is no doubt. The employment of coloured labour that is to say, of Lascars—is barred, and the speed of the contract is considerably increased. Two days and a half is to be taken off the journey between the Mediterranean mail port and the first port of call on the Australian Continent, and that will involve an increase in speed not far short of 10 per cent. Again, the minimum size of the ships to be employed in the service is to be 11,000 tons, and this will involve the building of a new fleet, comprising, at least, some eight bottoms, within the next two years. For there are no vessels of the speed and size required available for purchase or charter. Then there is the effect of the loss of their mail money upon the old contractors. They will, of course, be freed from many onerous obligations. But at the same time it must not be forgotten that any diminution in the regularity of their sailings, of the speed on the voyage, or in the class of ships employed, would be attended with a loss of passenger traffic. All existing lines must, indeed, be prepared to face that when a new competitor, with a fleet of which every unit surpasses everything at present in the trade, comes into the arena. The Orient Company is not in too strong a position now, and it cannot but be that in the future it will, at all events, for a time, find its struggles harder than they have been in the recent past.

I must, however, confess that my first feeling in regard to the matter was one of intense admiration for the instinct of Mr. Arthur Bibby, the Chairman of the Pacific Steam Navigation Company. For it will be remembered that at the beginning of the current year the Pacific Steam Navigation Company, recognising that its own trade needed all its attention in view of the developments taking place in South America, withdrew from its long partnership with the Orient Company. The West India Royal Mail Company, on the other hand, believing that its trades did not offer sufficient scope for the energies of its new management, took over the alliance with the Orient, and re-opened, as its Chairman pointed out, its connection with the Australian Continent, after the lapse of nearly half a century. What the consideration which passed between the two companies for the ships and goodwill involved may have been, has not been disclosed. But it would seem that the Pacific Company is much to be congratulated on the stroke of business which its board effected.

On the other hand, the new management of the Royal Mail has sustained another severe blow. Its troubles in regard to the West India Mail contract were faced with great pluck and determination. A new fleet is being provided to enable it to hold its own in the South American business. New routes are being opened up to give facilities to its customers, and this new venture into Australian waters was intended to give it a share in a mail contract in place of that which has, at all events, temporarily, been withdrawn from it.

The International Mercantile Marine Company.

The New York correspondent of the "Tribune" is responsible for the announcement that the Combine is about to build six fast steamships for its North Atlantic services, and that Mr. J. Bruce Ismay is the authority for the state-

ment. I have not the least doubt that the management would wish to do something of this kind, as they cannot be satisfied with the position which makes them, at least once a month, inform the Postmaster-General that they are despatching one of their slower steamships from Liverpool on Wednesday, with the result that the mid-weekly mails must go by the German steamship leaving Southampton on that date. But it seems a little hard to see how they will get the money to pay for them. I do not suppose that anyone will advance money on the existing ships, already heavily mortgaged as they are.

Money will evidently be required for them, for Mr. Ismay is reported to have said that some of them will "rival the *Lusitania* in speed," "though it is not certain whether they will exceed 25 knots." This is a somewhat cryptic saying, for one would imagine that to compete with the ship named they must exceed the speed mentioned. If they do, the Combine must be prepared to find not less than a million and a quarter sterling in hard cash to pay for each of them. So I think these ships will remain on paper, and will assuredly not have turbine engines, or, indeed, any engines at all. Mr. Pierpont Morgan was certainly well advised in declining to say anything to would be interviewers when he passed through Liverpool to embark on the *Baltic* on July 18th.

Another Unfortunate Accident

befell that unlucky ship, the Hamburg American liner *Deutschland*, at Dover on Friday, July 13th. As she was was leaving the harbour at 11.35 a.m., having shipped the last of her passengers and mails for New York, the order was given for the engines to go astern, in order to back the ship out from her quay, but by some inadvertence, of which the cause is at present unexplained, the engines were put ahead. The mistake was quickly realised, and the proper direction given to the machinery, whilst other means were taken to stop the ship's way by dropping her anchor. But there was no time to get her way off, and she struck the granite pier, with the result that her bows were split from the rail to the keel, the plates being rolled back to starboard. Her collision bulkhead, of course, confined the water to the fore peak, but her injuries were such as to cause the abandonment of her voyage and her detention for repairs. Her 1,200 bags of mails and her 1,500 passengers had to be sent forward by other conveyance, so that altogether the accident is an unfortunate and most expensive one.

The incident is not without its lessons as to the facilities of the ports. At first it was said that the *Deutschland* would return to Hamburg for her defects to be made good, and no doubt that would have suited her owners best. Then it seemed that Messrs. Harland & Wolff could get matters through most expeditiously, and, after all, time means money with these big ships in the middle of the passenger season. But, as we know, there is a dearth of dry-docking facilities for big ships at Belfast, so it became a question as to whether the ship had not better go to Liverpool, where, of course, the big *Georgic* repairs have recently been successfully accomplished. But, in the end, after eight days spent in negotiations, on July 21st, the tug *Hector*, of Southampton, assisted the *Deutschland* to voyage from Dover to the Solent, and the London and South Western Docks will see the job through. It is said now that the damage is so serious as to be likely to take some time to make good. Moreover, the owners deny the statement that the striking was due to any mistake in orders. They attribute it to the parting of a hawser.

Sir Alfred Jones,

the head of the great firm of Elder, Dempster & Co., has received a high honour from the King of Spain, who has created him a Knight Commander of the Spanish Order of Isabel la Catolica. The possession of this order, though not, I believe, a very ancient one, is much prized by the Spaniards, and it is seldom given to any but Spanish subjects. Few Spanish subjects, however, have done as much as Sir Alfred has done for the dominions of the King of Spain. He found the Canary Islands staggering under the disaster which killed their old staple industry, the cultivation of the cochineal. It was a catastrophe which even the famous panacea of a Royal Commission seemed powerless to touch. Sir Alfred went quietly to work, and introduced the banana, with the success which everybody now recognises. Not only did his firm provide means of conveyance for marketing these goods, but he was able to advise how best to grow them; he taught British consumers to appreciate their good qualities; he overbore the opposition of the Covent Garden people to them; and he built up a great trade and an ever-increasing demand for them. Thus he was enabled, when the time came, to extend a helping hand to our own West India Islands, stricken by the displacement of the cane for sugar-growing. Our Government does not recognise any but party services—the larger politics which spell patriotism, and which affect such men as Sir Alfred Jones and Cecil Rhodes, are often rewarded with abuse and innuendo.

It has not, however, been only with the banana that the firm of Elder, Dempster has aided the Canary Islands. They have built up a great tourist traffic, and founded hotels and other conveniences for travellers, so that now comfort and luxury are found everywhere. I remember twenty years ago the rough and uncomfortable conditions under which the traveller viewed the beauties of the islands. The new hotels have not only given the tourists new fields to traverse—they have brought much British gold to be dispersed amongst the inhabitants of these once more prosperous islands. The King of Spain, like the Kaiser, sets a good example to other potentates by honouring such a man as this.

The New Route of the Great Western Railway

to Ireland is approaching its opening stage. All three steamships have satisfactorily passed their trial stage, and on Saturday, July 21st, the Great Southern and Western Railway Company of Ireland celebrated the opening of the Rosslare branch, which it has constructed in conjunction with the English Great Western Railway. Not only has the new line been built with a view to the running of the fastest traffic—a thing of which the importance has, unfortunately, been clearly shown within these last few weeks—but the port of Rosslare has been fitted up with every up-to-date accommodation for passengers and goods. Boat-to-train facilities are, of course, provided, and, in addition, for those who wish to break the journey, there is a first-class hotel provided, under railway management.

Another Railway Development

is the dock scheme which is being fathered by the Great Central Railway Company at Immingham. This undertaking has really got beyond the scheme stage, for the first sod of the works was cut by Lady Henderson, wife of the Chairman of the railway company on July 12th. The first instalment of the new dock system will have a deep-water area of no less than 38½ acres, and will consist of a basin 1,100 ft. square, with an arm at its south-western corner. The length of the branch will be 1,250 ft., and its width 375 ft., with a total quayage of 6,760 lineal feet in the two portions. The site has been well chosen, for the deep-water channel of the Humber passes close to the entrance of the dock, and all that will be required will be the dredging of a short cut some 300 yards in length, to link the dock entrance with the main channel. Nowadays modern vessels are of such large draught that the depth of water is an important part of any dock scheme. At Immingham the bottom of the dock will be 32 ft. below high water at neap tides, whilst the entrance lock will have a depth of 47½ ft. of water on the sill at high water, or 28 ft. at low water of ordinary spring tides. A line of railway, four and a half miles long, will join the port with the Great Central's main system at Ulceby, whilst a light railway to Grimsby is also to be provided. On either side of the entrance there will be jetties extending to the low-water line. These will be constructed of open piling to obviate any danger of the main channel becoming silted up by the scour of the tides. They will also form a convenience for the disembarkation of passengers and live stock, and to allow vessels to come alongside them, deep-water berths will be dredged beside each. The undertaking is sanctioned by the Humber Commercial Railway and Dock Act of 1904, and for the purpose of the new port a total area of some 616 acres of land has been acquired by the company. Generally, it may be said that the site is considered an ideal one, and it is believed to offer advantages to the south side of the Humber, with which no existing port can compete.

The Singapore Docks.

Original shareholders in the Straits Settlements and the Tanjong Pagar Dock Company, Limited, may be congratulated on a highly satisfactory investment. The company has, of course, built up one of the most important dock and shipbuilding and engineering works in the East. Nearly two years ago the Government of the Straits Settlements

determined to acquire the company's property, and, in fact, took it all over thirteen months ago. The price was to be fixed by arbitration, and an imposing expedition of arbitrators, counsel, and others, visited Singapore last October. The results of the inquiry are now published. The capital of the dock company was 3,700,000 dol., in shares of 100 dol. each, and it was mentioned in the House of Commons the other evening that the Government might have bought the company out at a price of 225 dol. a share. This, however, for some reason, it would not do, preferring to go to arbitration. In the event the taxpayer has had to pay dearly enough. The authorities will have to raise a loan of £5,250,000 sterling to settle the debt for their purchase. This total is reached by the addition of several items, viz., the value of the docks, &c., as fixed by the arbitrators, 27,929,177 dol.; other items, 418,937 dol.; compensation to the directors, amount undisclosed; costs of reference, amount undisclosed. Anyhow, the lucky holders of shares get 755 dol. for what apparently they would have accepted 255 dol. less than two years ago. This surely is not an encouragement to the Government to pursue a policy of arbitration.

The Canadian Mails.

Up to the time of writing, the new "Empresses," though still advertised as the fastest in the Canadian trade, have not yet justified their claim, for the record still remains with the Allan Company. Moville has been finally condemned by the Post Office on account of the delays which present fast steamers, which run across from Liverpool in, say, twelve hours, must suffer whilst waiting there for the mail bags. It seems that Friday is to be the sailing day of the joint Allan-Empress mail service, and that by this route in future will go much of the Canadian mail matter which formerly passed through New York.

Russia and the United States.

Some of my readers may possibly remember that just before the outbreak of the Russo-Japanese War certain vessels of the Russian Volunteer Fleet were being prepared to open a fast service between Odessa and New York. For reasons connected with national defence, or, should I say more correctly, national aggression, the Volunteer Fleet keeps up, and even adds to, the number of its ships capable of use as auxiliaries to the Imperial Navy in time of war, although their old occupation of taking out troops and convicts to Vladivostock is largely taken from them owing to the opening of the Siberian Railway. The New York service was hit upon to find another outlet for their energies. But the war came before anything was done, and interference with shipping under the Red Ensign seemed a more worthy occupation for the *Rion* (or *Smolensk*) and the *Petersburg*. The peace has, however, put a stop to that form of employment, and so the Atlantic trade has again come to the fore. But Odessa is no longer in favour as the headquarters of the line, possibly from the fact that South Russia is so restless and the Black Sea so disturbed. At all events, Libau, in the Baltic, has taken Odessa's place, and the service thence has already been opened by the notorious *Smolensk*, which has just completed a big overhaul on the Tyne to fit her once more for mercantile pursuits. With her are to be engaged the *Petersburg* and the *Saratov*, and at first the service will be only a monthly one. It is expected that the many Russian emigrants who have hitherto gone by the German lines will take advantage of the new route, which offers them an escape from the long and unpleasant overland journey before embarkation, whilst giving them the doubtful privilege of a little longer sojourn under the flag of the Czar. Further, it is hoped that good return cargoes of American manufactured goods and of raw cotton will be found for the direct vessels. Libau considers itself nowadays, since the Government has gone in for the provision of ice-breakers, an all-the-year-round port.

The Volunteer Fleet

has had so many steamships passing and repassing through its hands, under so many names, during the period of the war, that it seems hard enough to disentangle their identity. I may, however, point out to a correspondent who enquires on the subject, that the *Smolensk*, now on her way to New York, is the original vessel of that name which was built by Messrs. Hawthorne, Leslie & Co., at Newcastle. She was taken over by the Russian Government, and used as a cruiser, under the name of *Rion*, during the war. She has now gone back to her old name and more peaceful occupations. Again, I may tell the same enquirer that the *Kazan*, lost on the coast of Ceylon in the spring, is not the vessel which was purchased a few years ago from the Pacific Steam Navigation Company, and renamed the *Kazan*. The stranded ship was formerly known as the *Narva* in the Volunteer Fleet. She was an English-built ship, but one of quite a cargo type.

Speaking of the Pacific Steam Navigation Company, I may record the fact that, with the advent of the new "O." mail steamships, the former White Star liner *Gaelic* is removed from the mail and passenger side of the company's service, and becomes a cargo vessel. She is now re-named *Callao*, and sails for South America on July 28th.

A New Type of Cargo Vessel

is exemplified in the Anglo-American Oil Company's ss. *Tioga*, which has just had an overhaul at Birkenhead. This vessel, formerly employed in the carriage of petroleum in bulk, has now been adapted for the transit of creosote, and for that purpose has been fitted with some thousands of feet of steam piping. It is believed that this will be found a safer and more economical method of transport than the old arrangement of carrying solidified creosote in barrels.

Accidents.

The Liverpool coroner's jury has arrived at its verdict in the matter of the explosion aboard the *Haverford*. But the experts were somewhat at variance in their evidence, a mass of people who could show some qualification being called to disprove the suggestion that the naphtha given off by the soap could have caused the explosive vapour. But certain experiments made by Mr. Collingwood Williams seemed conclusive with the jury, especially when he gave them a demonstration in court, and showed them a blue flame from naphtha-vapour caught in a bottle, in which some of the soap had been kept. How the vapour was ignited will remain a mystery. In spite of the difference of opinion amongst the experts, I am inclined to believe that the jury took the right view, and for this reason. I was impressed by the evidence of an engineering witness, who stated at the earlier hearing that his experience was that the damage was usually *away* from the place where the explosion originated. That experience seems to coincide with what one would expect. And applying it to the present facts, one finds that it was stated that the soap was stowed on the port side of the vessel, whilst the worst damage sustained—except, of course, the unhappy loss of life—was the blowing out of the starboard side of the ship. It might be well, too, to record the fact that the Bootle jury did not go through the farce of hearing all the witnesses over again. But it was too cautious to bind itself to the finding of its Liverpool counterpart. It returned quite an open verdict. This not only refused the suggestion that there was a case of suspicion against the soap, but also was so worded that, as the coroner pointed out at the time, it did not even shut out infernal machines as a possible cause of the disaster. Anyhow, it seems to be certain that it would be well for vessels which carry general cargoes to pay particular attention to the ventilation of their holds, for even apparently innocent goods may, under certain circumstances, prove a source of mischief.

The "Carlisle" Inquiry.

There are several aspects in which the enquiry and following appeals with regard to the loss of the steamship *Carlisle* are of interest to all seafarers. In the first place, it is well that the dangers of being shipmates with smokeless powder of a certain age should be recognised; and, in the second place, there is much to be learned as to the true relations between the Board of Trade and its certificated officers. As some of my readers may be aware, the steamship *Carlisle* found herself in the port of Saigon about the middle of the year 1905, with a large quantity of explosives in her hold. The stuff was consigned to Russian account, and the fortunes of war had made it practically impossible for the owners to take delivery. So there the ship stayed on month after month, the crew remaining aboard, though the master went to a hotel. Early in December fire broke out, on two separate occasions, in the cargo, and some of the crew left the ship in consequence. The master then called in an expert, of whose qualifications apparently the French authorities had a high opinion, and he made a partial examination of the cargo. He told the master on what he saw, that, though he had not made a complete examination, he had, at all events, seen enough to justify him in telling the captain that there was no danger of further outbreaks. Thereupon the master ordered the men back, and the Consul, to whom they went on their own account,

endorsing the master's words as to the expert's opinion, the crew made no trouble about returning to the ship. But early in January there was a third explosion, and this time the *Carlisle* was destroyed. The crew with difficulty got ashore, and two of its members were missing. These facts having been laid in evidence before a court of inquiry at Cardiff, the counsel for the Board of Trade asked if the master had been guilty of a wrongful act or default, which caused the loss of life which unhappily occurred. The court, in answer to this question, stated its opinion that the master had shown a want of care for his crew in not berthing them ashore after the earlier explosions, and suspended his certificate for twelve months. Against this decision the master has successfully appealed. The grounds on which the appeal was allowed were that, as he had the opinion of an expert to the effect that there would be no dnager in the crew returning aboard, he had not, in fact, been guilty of such wrongful act or default as the court had found against him. Then he asked for the costs of his appeal. It may be remembered that in previous cases masters have, notwithstanding the fact that they have succeeded in their appeals, been left to pay the costs. Captain Simpson, however, was more fortunate, succeeding in this matter also. Incidentally, he elicited from the Divisional Court of the Admiralty an important pronouncement as to the duty of those who represent the Board of Trade at these inquiries in the line of conduct they pursue towards the certificated officers concerned. But the immediate point for our readers is the knowledge that they are placed in the position of ordinary suitors to the courts, and are able to feel that if they have been hardly dealt with by courts of inquiry they can look to recovering their costs if it should prove that they have been too hardly dealt with. The benefit of this decision extends, of course, to engineers as well as to the navigating officers.

The Norddeutscher Lloyd,

which possesses three fast steamships of a speed surpassing any ocean vessel as at present flying the British flag, has naturally the largest experience of the effect on passengers of rapid steaming against head winds. Its experience has led one of its directors to produce a wind-shelter, which is now being fitted to the steamships of the line. The idea is to provide transverse walls or screens on the promenade deck, which, whilst affording a sufficient measure of shelter to those who seek their benefit, shall at the same time be easily removed when not actually in use, and shall be capable of being stowed in small compass. The screens can be made either of wood or of canvas fixed to a frame. Their lower edges have hooks which engage in sunken ringholes in the deck, whilst their upper edges are pierced with holes, through which thumb screws can be put to fasten them to the girders of the shelter deck above. I understand that these Comfortable Deck Shelters, as they are called, are already fitted to several of the company's steamships, and are giving satisfaction to those for whose benefit they were designed.

Fleets.

On August 2nd, an Atlantic liner is to be offered for sale by Messrs. Kellock's. This is the iron steamship *Kansas*, of the Warren Line. She is a vessel of nearly 5,300 tons gross register, built in 1882 by Messrs. C. Connell & Co., of Glasgow, and fitted with refrigerating machinery and electric light. She can accommodate about 1,000 head of cattle. I fancy her most recent employment was in shifting troops on Russian account.

An Unlucky Ship.

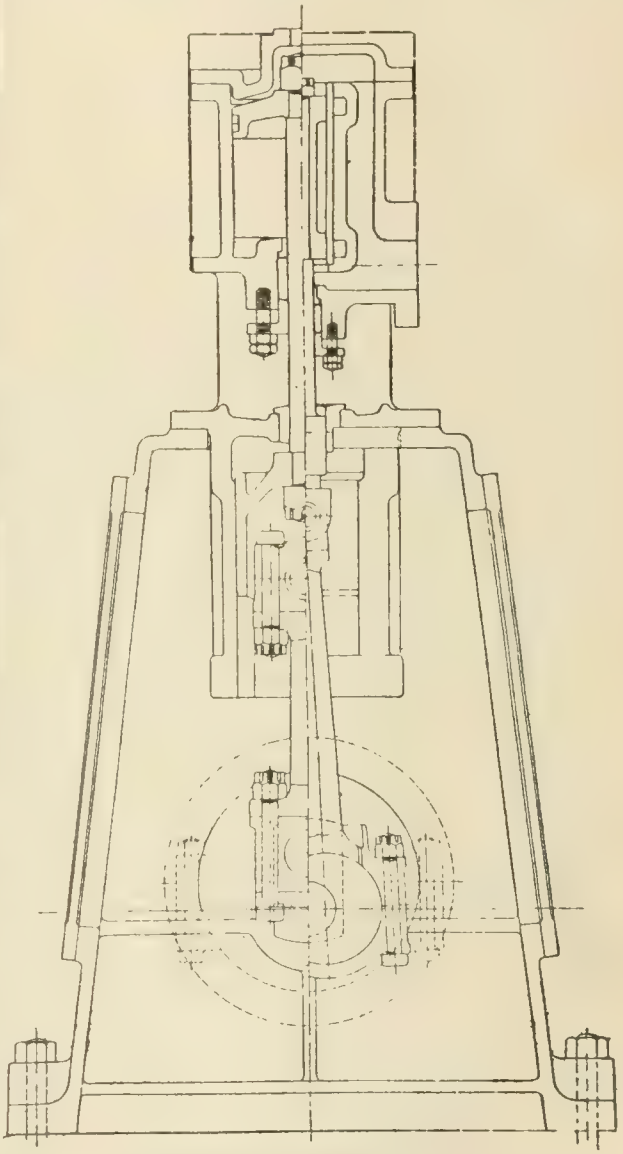
Hope of refloating the Elder, Dempster Line steamship *Angola*, ashore near Louisburg, seems now to have been abandoned, though the process of lightering the cargo is being continued. The *Angola* is a steamship of the African Company. She was built at Middlesbrough in 1891, her gross register being about 2,900 tons. This is the vessel which some eight months ago stranded at Havana when engaged on Messrs. Elder, Dempster & Co.'s new service from Canadian to Mexican and West Indian ports.

The Liverpool Salvage Association does not seem to be taking a very large share in, at least, the direction of the salvage operations at H.M.S. *Montagu*. The prospect of success seems to grow more remote. Preparations for two attempts have already been made in July, but on each occasion the state of the weather has rendered it advisable, in the opinion of the naval officers present, to make further postponements; and August 5th is now the earliest date on which another trial to get the ship off can be made.

ELECTRIC GENERATING PLANT.

WE illustrate, in the adjoining diagram, a sectional view of one of the standard steam dynamos as supplied by Messrs. Veritys Limited, of London and the provinces, to various foreign Admiralties for ship-lighting work.

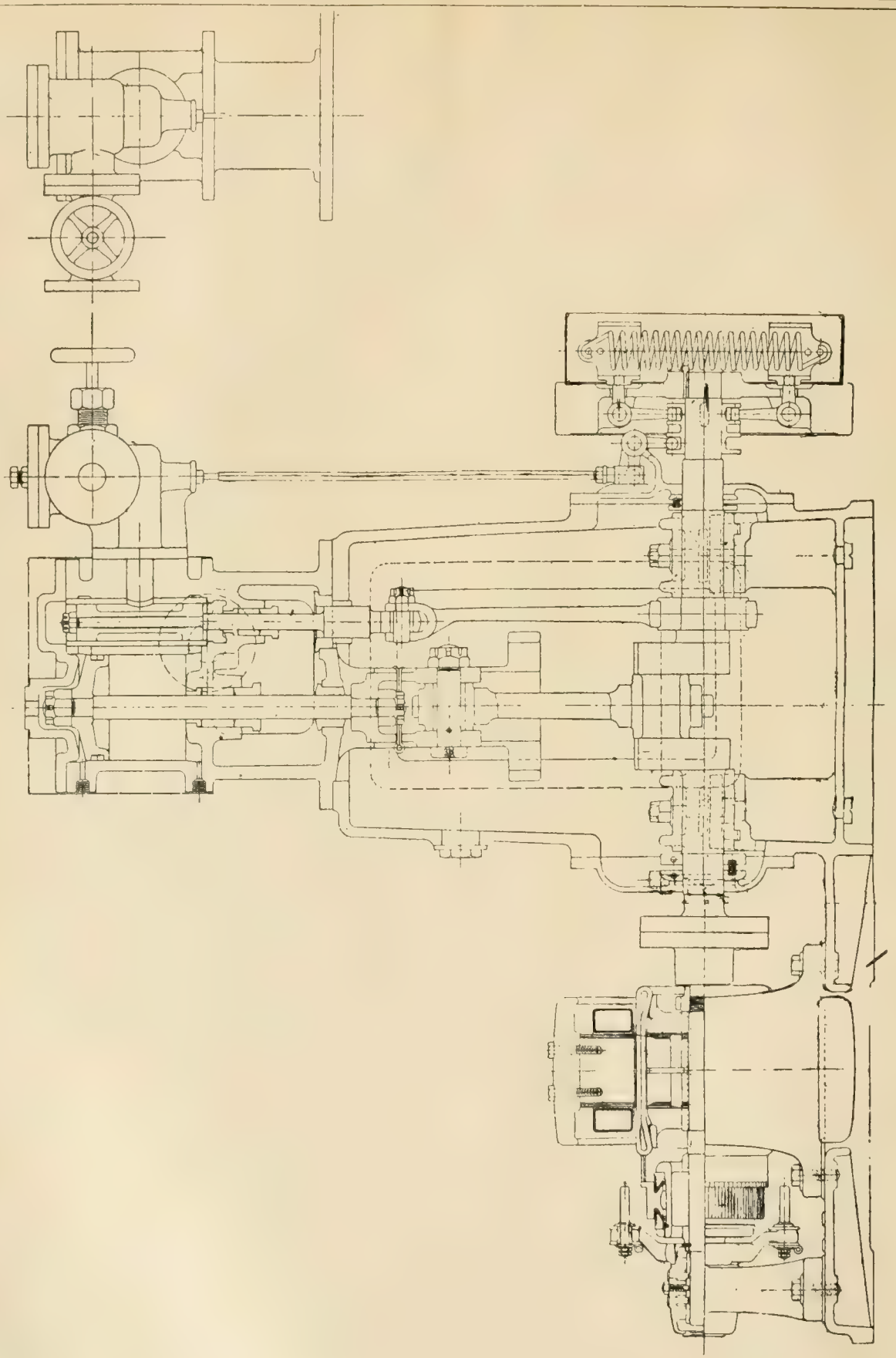
One of the principal features in this machine is the special provision of means for ensuring the insulation and ventilation of the dynamo to be of the highest efficiency, in order to enable the machines to be run under tropical conditions.



Electric Generating Plant.

The machine consists of an Aston type generator coupled to a Reavell double-acting engine, the generator being of open construction, while the engine is totally enclosed to comply with the usual conditions of high-speed running.

Dealing first with the generator, the armature is constructed with air ducts, which run parallel to and radially with the shaft, thus setting up a com-



Electric Generating Plant.

plete circulation of air through the armature, whereby the windings and commutator are kept cool, so that the maximum rise of temperature under normal conditions of running is never excessive, and the machine will take an excessive over-load in an emergency without fear of breakdown. The brush-holders are of substantial design, and are readily accessible.

The commutator is built up of sections of hard-drawn copper, insulated by mica, which latter is selected so as to wear down at the same rate as the copper, in order to avoid sparking due to uneven wear of the commutator. The shaft carries a bush, on which the commutator is built up, and thick mica rings are used to insulate the shaft from the bush.

The windings of the machine are readily accessible, and are easily capable of being fully exposed; the armature and field magnets being easily withdrawn without disturbing the carcase of the machine from the engine-bed on which it is bolted.

It will be noticed that only one pedestal is provided on the dynamo, enabling the machine to be considerably shortened, an important point for marine work.

Turning now to the engine, the standard carries the main bearings at its lower part, and is fitted with doors back and front, to enable the crank-shaft brasses to be readily adjusted. The bed-plate and standard being cast in one piece, and to enable the crank-shaft to be withdrawn, arrangements are made for readily unshipping the governor-disc, and drawing the crank-shaft endways through suitable end covers on the standard.

The cylinders, distance-pieces, and guides are cast in one piece, so as to ensure absolute alignment, and the piston and slide-rods are fitted with top and bottom glands, to prevent any escape of oil from the crank chamber, and to keep the lubrication cool by preventing the oil from coming into contact with the bottom of the cylinder.

The governor is of the double-weighted, single-spring, centrifugal type, operating a throttle-valve.

It should be noted that the generator is fitted with subsidiary poles, owing to which the machines are called "Interpole generators." These interpoles, which are situated between the main poles, are not shown in the drawing, but we understand that the efficiency of the generator is much increased thereby.

Institute of Marine Engineers (Junior Section).—The Institute of Marine Engineers proposes to give special attention during next session to the apprentices, to young engineers who are entering upon marine work, and to junior engineers, who are looking forward with expectancy to the higher grades of sea-going life, with shore appointments in the future. A circular has been issued on the subject, inviting all those who are interested in thus bringing the rising generation of marine engineers into close touch with the practice and development of marine work. This is as it should be. The object is a most desirable one, and ought to appeal forcibly to those it is intended to cater for, as well as to their parents and guardians. At a meeting held to consider suggestions, a committee of juniors was appointed to consider the matter, with a view to the establishment of a junior section, to be managed by the juniors, under the authority of the Council. There is ample scope within the premises of the Institute for such a section; the workshop and tools, the museum, the library, reading-room, lawn-tennis court, experimental department, and the social elements which can be developed, afford many opportunities for that success which is wished for, and deserved, in a good cause.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondents at home and abroad.)

The Navy Estimates: New Construction.

THE Parliamentary paper which was issued in the last days of July, and entitled "Memorandum Explanatory of the Programme of New Construction for 1905-06, with Details not included in the Navy Estimates for 1906-07," had the appearance of a belated document, and was, in fact, not a little out of date. The official description of the *Dreadnought*, which forms the major portion of its contents, is not remarkable for its novelty, and, indeed, adds but little to the information which has for some time past been at the disposal of the readers of this journal. For purposes of comparison and reference, it seems to be worth while to give those parts of the description about which there has been some mystery hitherto, and this portion of the Memorandum dealing with the genesis of the design of the *Dreadnought* and her principal features, will be found below, under a suitable caption. It seems to be a subject for regret that the Admiralty should not have taken the public similarly into its confidence regarding the new cruisers of the "Invincible" class, but, from the figures which are given in the tables usually presented with the Estimates, some interesting comparisons with the *Dreadnought* design may be made. Thus, the "Invincibles," with a length of 530 ft., are 40 ft. longer than the *Dreadnought*, but have 3·5 ft. less beam, that of the battleship being 82 ft. The difference in draught is 6 in., the "Invincibles" drawing 26 ft. to the *Dreadnought's* 26·5 ft. The weight of hull of the cruiser class is 1,440 tons less than that of the battleship, but the total displacement, being 17,250 tons, is only 650 tons less. The *Invincible*, at load draught, will carry 1,000 tons, while the *Dreadnought* carries 900 tons, but nothing is said about oil fuel, except that arrangements have been made for stowing and using it. Generally, it may be assumed that, while the speed of the cruiser is much greater, her weight of armour and armament is less than that of the battleship, and further details on these points will be awaited with interest and some anxiety, seeing that the total cost of the former, approximating to a million and three-quarters, is only about £60,000 less than that of the latter.

Portsmouth Dockyard.

The *Dreadnought's* armament is expected to be completed by the end of the month, and it is practically certain that she will be ready for her trials in September. The orders as to anyone going on board are, however, still as strict as ever. The opinion in dockyard circles is that our new vessel—by the way, no intimation has yet been received as to when she will be laid down—will be another *Dreadnought*. It will not be long, however, before we know something about it. The work of lengthening No. 5 Dock is now completed. I have already mentioned about three vessels being moored at Spithead to make more room in the harbour. That, however, was found to be so crowded, in consequence of the presence of several vessels of the Atlantic Fleet, that the battleship *Centurion* was also sent out. The *Terrible*, which accompanied the *Renown* to India, and afterwards acted as flagship during the manœuvres, joined the Reserve Division temporarily, but she has now left for China with relief crews, being due back on November 11th. The battleship *Canopus*, of the Channel Fleet, has arrived to complete her fire-control installation, and the *Hampshire*, of the First Cruiser Squadron, for her annual refit. The *Kangaroo*, *Waveney*, and *Boyne*, of the First Destroyer Division, are under orders to come here to have their defects made good. We have had a Royal visitor, in the shape of the Maharajah Dhiraj of Birdwan, who was the guest of Admiral Sir Archibald Douglas, at Admiralty House. His Highness made a tour of the yard, and went, in the *Firequeen*, to Cowes, to pay a visit to the Royal Naval College, at Osborne. The *Renown* is to be guardship at Cowes during the King's visit, in August; she will possibly also be a guest ship, in view of the large number of distinguished visitors expected. It is not often that a captain is again appointed to the same ship, as Captain the Hon. H. Tyrwhitt has been. A start was made when the vessel returned from India to restore her to her proper *rôle* of battleship, but not much was done, and

she is now practically the same as when the Prince and Princess of Wales used her. Mr. Lambert and Mr. Robertson came down for a week-end visit. They stayed on board the Admiralty yacht *Enchantress*, and paid a visit to the *Dreadnought*. The *Britannia* returned to this port on the completion of her steam trials, which were satisfactory in every way. Our torpedo-boat flotilla has also come back, after a week's cruise in the neighbourhood of the Channel Islands. The *Argyll*, of the First Cruiser Squadron, is also here, from Portland, for a refit.

The "Dreadnought" Design.

With regard to the genesis of the *Dreadnought*, the official Memorandum states that the Admiralty appointed a committee of naval and scientific experts as an advisory body to assist them in coming to a conclusion upon various important features in connection with the type, but it was no part of the function or purpose of the committee to relieve the Director of Naval Construction of his official responsibility. The committee, after considering six alternative designs for each class of battleship and cruiser, unanimously decided to recommend those designs which, after further discussion with the Commanders-in-Chief of the Channel and Atlantic Fleets, were ultimately adopted, with the concurrence of Sir Arthur Wilson and Sir Edward May. The main armament of the *Dreadnought* will be ten 12-in. guns, six of these guns mounted in pairs on the centre line of the ship, and the remaining four in pairs on the broadside; thus, 80 per cent of the main armament can be fired on either broadside, and 60 per cent. right ahead or right astern. In this way, all-round fire, the most important, is obtained, since it thus lies in the power of the commander of a vessel to force an adversary who is anxious to engage to fight an end on battle. The anti-torpedo guns are twenty-seven 12-pounder quick-firers, these guns being of a new design and greater power than those previously carried for use against torpedo craft, and being more widely distributed as well. Five submerged torpedo tubes will complete the armament. To increase the command of the forward guns, a forecastle is given to the ship, so that she will have a free board forward of 28 ft.—higher than that of any modern battleship. The main armour belt has a maximum thickness of 11 in., tapering to 6 in. forward and 4 in. aft; the redoubt armour varies from 11 in. to 8 in.; the turrets and fore conning tower are 11 in. thick, the after conning tower 8 in. thick; the protective deck varies from 1¾ in. to 2¾ in. in thickness. Special attention has been paid to safeguarding the vessel against under-water explosion. The speed is to be 21 knots, obtained with water-tube boilers and turbine engines. She will have a coal-bunker capacity of 2,700 tons, which, at 18½ knots speed, will give her a radius of action of about 3,500 sea miles, and this without taking into account the oil-fuel supply, which will largely increase it. The principal officers will have their quarters on the main decks forward, near the conning-tower, and the other officers will also live forward, the remainder of the crew being berthed on the main and lower decks aft.

Devonport Dockyard.

Both the *Hibernia* and *Minotaur* are making good progress. Three 12-in. plates for the former vessel have arrived, completing her armour protection, while about fifty tons of side-armour were fitted to the *Minotaur* in the same period. About half of the boilers of the latter vessel have also arrived, her conning-tower tubes are on board, and some of her gun supports in position. The rumour that the Reserve Divisions are to be abolished is given credence to by many of the well-informed people here, who say that in these days of change—and of economy anything may happen. If the old system were resorted to, it would show a saving for a time, but probably not in the long run. Captain May's successor in the *Vivid* is Commander H. J. Savill, who has been at this port, on Admiral Sir Lewis Beaumont's staff, since the end of last year. The battleship *Victorious* has left to rejoin the Atlantic Fleet, but she will return about the middle of August, as Sir Archibald Berkeley Milne is to be succeeded, on the 25th, by Rear-Admiral G. Le Clerc Egerton, whose flag captain will be Captain R. F. Scott, of *Discovery* fame. The *Roebuck*, of the Third Destroyer Division, is due here to be overhauled. The Bodmin election affected us a little, as many of the workers in the yard live in that division of Cornwall. The voters are better off than many in private employ, for they will be paid for their afternoon's holiday. So, in some respects, Government service is not so bad, after all. The surveying vessel *Goldfinch* has arrived from the West Coast of Africa, for her annual refit, and the cruiser *Donegal* has come round from Chatham, and joined the Reserve Division. The battleship *Victorious*, having had a new propeller fitted and some minor defects made good, has been undocked, and taken her departure, to rejoin the Atlantic Fleet. The *Highflier*, of the Fourth Cruiser Squadron, was paid off and recommissioned recently for the Reserve Division by Captain Christian, a well-known officer at this port. Before his promotion, a year ago, Captain Christian was commander of the boys' training-ship *Impregnable* for some years. Talking of the *Impregnable* reminds me of the inter-training ship sports just held, which were arranged by Captain Burney, of that vessel. It was unfortunate that the lads of this port did not prove themselves worthy of their captain's confidence, but they were not in it with the Shotley lads, who carried off the cup, with forty-five points to twenty-five. Let us hope that the *Impregnables* will do better next year. The battleship *Implacable*, which came home to recommission, has returned to her station in the Mediterranean. She received an excellent send-off from her station. Lord Charles Beresford went on board, and made a speech, in the course of which he wished them all good luck, and concluded by saying that the vessel was a credit to the flag. In sixty-seven evolutions the vessel was first, second, or third fifty-one times, and first twenty-four times. Captain Patey has good reason to be proud of his old ship's company.

The Small Craft of 1905-6.

A number of interesting details not hitherto made public about the destroyers and submarines of the programme of 1905-6 are supplied in the Admiralty Memorandum; but most important of these are the particulars concerning the *Swift*, a destroyer of special type and remarkable character. This vessel will be 345 ft. in length, 34 ft. in breadth, and draw 10 ft. 5 in. at mean load draught. She is thus longer than some battleships and many cruisers, and may be compared with the ocean-going destroyer *Cossack*, which is 270 ft. long, 26 ft. beam, and draws 7 ft. 5 in. of water at mean load draught. The displacement of the *Swift* is to be 18,000 tons, compared with 2,940 tons of the "Scout" class, or 795 tons of the "Cossack" class. Her engines will have 30,000 I.H.P., which is equal to that of the *Drake*, more than double that of the *Cossack*, and nearly double that of the "Scouts." Her speed of 36 knots will be greater than that of any other vessel afloat, the "Cossack" class having 33 knots and the "Scouts" 25 knots. She will also carry nearly three times as much fuel as most of the destroyers. From these details, it is obvious that the *Swift* is somewhat of a revolution, even in respect to destroyers, which have shown such marvellous differences and developments since they were first invented. The Memorandum refers to the potentialities of torpedo craft, and the arrangements which have been made in the *Dreadnought* with a view to meeting them; but it is clear that the exertions of any ship's company will be put to a tremendous strain to meet the onslaught of a flotilla of 36-knot craft like the *Swift*, armed with the latest type of torpedoes, of long range and exceptional accuracy. The attack by such vessels towards the end of a fleet action, when the men have been strenuously engaged for some time with larger antagonists, will call for immense exertions, particularly if these destroyers are manned by crews exhibiting the skill, energy, and reckless disregard of life which characterised the onslaught of the Japanese during the late war.

Sheerness Dockyard.

The electric light installation is under way again, and a start has been made with the building of the generating station, the foundations of which were laid over a year ago. The scheme—which has been "hung up for some time—will not, however, be on such an elaborate scale as was at first expected. We have a new commander of the flagship *Wildfire*, Commander Lumsden having left in consequence of his having been promoted to captain's rank; he has been succeeded by Commander C. H. Morgan, who was recently in command of the destroyers at Gibraltar, having previously been for three years navigating officer of His Majesty's yacht *Osborne*. Our flotilla of destroyers and torpedo-boats has proceeded to Felixstowe, where they are to be inspected by Rear-Admiral Winsloe, who commands all the torpedo craft both in commission and in reserve. The first batch of workmen who went from here to Gibraltar to repair the *Assistance* are expected to return in August, so presumably that vessel is getting on towards completion. Although not a dockyard matter, the fact that

the Brinsmead Shield has been won at Bisley for the second year in succession by the Gunnery School team has given great satisfaction to us all. Visitors to the school will, therefore, again have the pleasure of seeing the shield in the trophy case. As regards work generally, that is in much the same condition. The sloops *Merlin* and *Fantome* are being converted into surveying vessels. The cruiser *Talbot*, which escorted the Prince and Princess of Wales to Norway, has reverted to the Reserve Division, the nucleus crews of which ships are, it is reported, to be reduced; but I can hardly think that such a thing will happen when the system has just proved so successful. Moreover, the manœuvres have proved the economy of the nucleus system. The destroyer *Griffon*, lately of the Atlantic Fleet, which was recently told off for this division, in accordance with the new arrangements, has arrived from Gibraltar, and new moorings have recently been laid down in Stangate Creek for a dozen of her class. We have had quite a number of arrivals since the manœuvres concluded. The *Black Prince*, of the Second Cruiser Squadron, is giving leave to her crew, and is now berthed off the pier. The *Cumberland*, of the same squadron, has gone on to Chatham for the same purpose. It was at first thought that she would have been refitted; but that is to be undertaken at Gibraltar, for which place she will leave before the end of the month. Other vessels passing through to the up-river port have been the wooden battleship *Ganges* and the battleship *Dominion*.

Salving the Battleship "Montagu."

The attempt which was made in the last days of July to get the ill-fated *Montagu* off the rocks at Lundy Island were only frustrated by the weather. This was indeed bad luck, because the weather has been so favourable hitherto, and only for this reason could the hope of success be sustained. But the island was enveloped by fog just as it was when the vessel went ashore, and a strong breeze from the south west, accompanied by a ground swell, was sufficient to interrupt and render the operations futile. At the same time, the measure of success was such as to justify the hope that at the next high tide early in August another effort may have a more satisfactory result. The battleship floated, and that is saying a good deal indeed, it may be held to justify all the efforts that have been made, and will be made, it is to be hoped, under more favourable conditions. The sealing arrangements of the lower part of the vessel appear to have been made as complete as possible, and also the coffer dams, which have been attached to the outside of the ship; the postponement of the salving operations will, therefore, be utilised to continue the work of removing the rocks, which have penetrated the hull, and others which are obstacles to her floating off. Two battleships were placed in position for hauling the *Montagu* off, and, according to a report, the *Dunvan*, one of these, was herself in some danger, which circumstance raises the question whether it would not be better to use tugs for the purpose, instead of risking the more costly vessels of war. Another question which has been mooted is connected with the value of the operations, even if they should eventually be successful. Is the *Montagu*, or can she be made, worth the expense incurred by attempting to get her off? This is a question which only the Admiralty, with all the facts at hand, is capable of answering. We know that there are precedents for the salving of such vessels, notably the *Sultan* and the *Howe*; but, although much money was spent on those ships, they never again were placed in the active service list. To-day our scientific arrangements are much better than they were then, and it will certainly be a feather in the caps of all concerned if they can once more make the *Montagu* a fighting unit of the British Fleet.

Chatham Dockyard.

A month ago, I told you that I had heard that while the battleship *Africa* was on her trials, she was perilously near the Lizard rocks in a fog. The other day, in answer to an inquiry on this subject, the Secretary to the Admiralty stated that "The engines of the *Africa* were reversed during her trials, on account of her getting into proximity to the shore in a fog; but it is not proposed to make any further inquiry." The officials here consider that the repairs to the *Donegal*, which has left for Devonport, were carried out in a most satisfactory and economical manner. It is to be hoped that the responsible officials will bear this in mind when allocating other repair work. The battleship *Swiftsure*, which has been in dockyard hands for several weeks, has been paid off, and recommissioned for further service in the Channel Fleet. The crew of the cruiser *Amphitrite* are under orders to proceed to Barrow to man the *Natal*, which is to begin her steam trials next month. The cruiser *Thetis* recently conveyed relief crews to Suez, and, on her return, was told off for the manœuvres; she has now been paid off and recommissioned for the Reserve Division. The remarks as to the apprentices' examination made by your Sheerness correspondent apply equally to us. If our thirty-nine successful candidates had competed at Devonport only four would have been selected, and if at Portsmouth only three. It is certainly a matter which requires looking into. The cruiser *Cumberland*, of the Second Cruiser Squadron, which had been here giving leave after the manœuvres, has left for Gibraltar, where she is to undergo her annual refit, much to our disappointment, as we had expected that work to be carried out here. The refit of the cruiser *Bedford* is to be completed at once. The repairs to this vessel, which has just arrived, were commenced previous to the manœuvres, but as she was required for the operations, they were not finished. Chatham was to the fore when the Estimates were discussed. I hear that the Mayor and the Town Councillors were in the House during the discussion, in order to keep an eye on their member. It seems to be a novel arrangement, but, in view of the condition of the town, and the prospect of a large amount of distress during the winter, any action of the kind is thought to be justified. Both officers and men of the battleship *Dominion* are looking forward with pleasurable anticipations to the Canada visit. The vessel has proceeded to Portsmouth to receive a silver centre-piece, which has been subscribed for by the Anglo-Canadian community of this country. In addition to visiting several Canadian ports, she will spend about a fortnight at Quebec.

More Lessons of the Naval Manœuvers.

Although the official report of the umpires anent the naval manœuvres has not yet been issued, the newspaper controversy aroused by the operations continues, and the journalists and others who were present draw their conclusions from the facts which came under their notice. Mr. Arnold White, in an article which has appeared in the *Daily Chronicle*, acknowledges that the Navy to-day is far stronger than was believed to be the case a month ago, but he thinks that it would be fallacious to conclude, on this revelation of unexpected strength, that a Government pledged to economy may safely reduce the shipbuilding programme, because ships under construction in 1906 form the fighting line in 1909. His contention is that we need more new ships, but fewer obsoletes. Sir William May, he declares, has proved that speed, gun power, and coal endurance are as necessary to modern battleships "as legs to a horse or brains to a man." It, therefore, follows that "safe economies in naval expenditure cannot take place in new construction, but that obsolete and obsolescent ships may be scrapped with impunity." The "Army and Navy Gazette," which is the representative organ of the Services, suggests that the moment is propitious for this country to take the lead in a reduction of armaments. The view of our contemporary is that the nation would suffer no loss, nor yet jeopardise its position if the year were permitted to pass without laying down a single armoured vessel. In support of this view, it is submitted that the Government is in an exceptional, and probably unique, position as regards naval affairs. Never before has the Fleet been absolutely and relatively so strong. Looking ahead, there are six battleships and nine armoured cruisers under construction, and with these battleships there should be no difficulty in fulfilling the requirements in Lord Cawdor's "Statement of Policy." If the French and German "Dreadnoughts" had been laid down, there might be reason in the appeal not to relax our efforts; "but, as things stand, the vessels referred to have not been laid down, and it seems to us possible for the British Government to make an offer which may result in their never coming into existence." This offer is that "Great Britain will abstain entirely and unreservedly for twelve months from any kind of expenditure on a new programme, and during that time she will wait and watch developments abroad, inviting other Powers to follow her example in the interests of economy, humanity, and peace," with the alternative of doubling the programme next year, and quickening the rate of progress.

Pembroke Dockyard.

The reorganisation scheme which has been received here from the Admiralty appears to be the death-warrant of Pembroke. It shows that the amount spent on labour here last year was £147,000, while the amount proposed for this year is £105,000, for the next year £73,000, and for the

year after £35,000. At this rate, zero will be reached about 1910, after which Pembroke as a Government establishment will probably be unknown. The figures indicate a reduction of about £15,000 on the amount proposed for the current year in the Estimates, and the reduction of the staff next year to about 1,000, and to half that number the following year. Another meeting to consider the proposed petition to the King or to the First Lord has been held, but nothing further will be done until after Mr. Robertson has made his statement. The uncertainty as to the future of the yard had, it was said at the meeting, "paralysed local business by practically destroying local credit." The Building Society could not advance money on loan, while the Co-operative Society had stopped payment of withdrawals. The plating of the *Defence* is now practically complete. It was done by a squad of five shipwrights and three apprentices, the time taken being thirteen months; but it must be mentioned that for a short time the squad was reinforced by four additional hands. However, it is considered a very smart performance. The job was piecework, and the men earned on an average about one-third more than day rates.

The Stability of Submarines.

Mr. J. H. Jeans, of Trinity College, Cambridge, and Sir William White have contributed to "Nature" an important and interesting series of letters on the stability of submarines. Mr. Jeans's statements and mathematical calculations show that a submarine moving ahead at 10 knots, even under perfect conditions, might apparently be expected to founder if its inclination at any time reached as much as 7 deg. Mr. Jeans goes on to say:—"Sir William White mentions that in the case of the submarine *A8* the hydrostatic metacentric height had been reduced, at the time the accident occurred, to 8½ ft. The further diminution in this height produced by a headway of 8 knots is about 6 ft.—by a headway of 9 knots is about 7½ ft., leaving only about 1 foot of effective metacentric height as the margin of safety. Obviously these rough calculations ignore a great number of factors which ought to be taken into account before accurate knowledge can be obtained. The most important of these factors is probably the proximity of the surface and the consequent formation of surface-waves. A calculation which omits a factor of this kind cannot lay claim to any value as advancing exact knowledge, but may serve the humbler purpose of suggesting possible, and even probable, dangers, and of emphasising the need for experimental knowledge, before this is forced on us by a catastrophe." Sir William White, in a subsequent letter, practically endorses Mr. Jeans's warning.

Failures of Shafts of Steam Vessels.—A circular letter of very great interest and importance to marine, and, indeed, to all engineers, was issued recently by Lloyd's Register of British and Foreign Shipping to superintending engineers and others, who might be able, from their experience, to express opinions, and offer suggestions on the subject of the failure of shafts. The large number of shafts which break while at work, added to those which are just caught in time to prevent disaster, by close examination and scrutiny, certainly warrant such a letter being issued; and, as no doubt many of our readers have met with experiences which would help to throw light on the subject, and add to the information which the Committee of Lloyd's is desirous of obtaining, in order to lessen the number of shaft failures and reduce the risk of broken shafts, those who have had opportunities of inspecting fractured shafts are invited to give the benefit of their observations for the general good. The points stated by the Committee for special observation are:—Ingot steel, scrap iron, and scrap steel, as material for the construction of shafts. The first named is, perhaps, considered preferable for shafts up to 15 in. diameter; but for propeller shafts, good iron, well forged, is looked upon by a large number of engineers as preferable to steel. The difficulty of obtaining scrap iron perfectly free from steel renders the position one of doubt in respect to the perfect homogeneity of the forging, and it is probable that the difficulty of selection has resulted in many bad shafts, due to portions of steel being mixed with the scrap iron used for the forging. It is pointed out in the circular letter that repairing workshops stock heavy forgings for shafts, to be ready for emergencies, and that these may be turned down abnormally if a smaller shaft is wanted than the diameter of the finished forging may have been intended for; the strongest part is thus removed in the outer skin.

MOTOR BOATS.

WE have pleasure in reproducing herewith photographs illustrating two motor-boats which Messrs. John I. Thornycroft & Co., Limited, of Chiswick, have recently completed.

The larger of the two (Fig. 1) is 32 ft. in length by 6 ft. beam, and is fitted with a Thornycroft 4-cylinder 20-H.P. motor (with reversing gear), giving a speed of about ten miles per hour. The hull is of mahogany, copper-sheathed, and the boat is arranged for the carriage of cargo in the fore part and four passengers aft of the motor. The engine is of their standard type, and is fitted with high tension electric ignition. The boat is intended for service in Rio de Janeiro Harbour.

The smaller boat (Fig. 2) is of a unique type, and is being supplied to the Indian Government under the supervision and inspection of Messrs. Rendel & Robertson, their consulting engineers. The dimensions are 19-ft. length by 5-ft. beam, and the draft is 4½ in. This abnormally small draft will enable the boat to be used in very shallow water. A single-cylinder 6-H.P. Thornycroft motor is fitted, which, by means of a stern wheel driven by a belt through reducing gear fitted directly to the motor, gives a speed of about six miles per hour. The engine has high tension magnetic ignition, and is of their standard type.

The hull is of teak, and is copper-sheathed, and it will be noticed that double rudders are fitted. She is intended for police work in Negapatam, a town in the Tanjore district of India.

OBITUARY.

William A. Bryson.

The death took place, on July 11th, at Trinity, Edinburgh, of Mr. William A. Bryson, consulting electrical engineer, Leith. Trained in his profession in Glasgow and Edinburgh, Mr. Bryson had charge of the work of installing the electric light at the Edinburgh Exhibitions of 1886 and 1889. For a time he carried on a consulting business in Glasgow, and, some ten or twelve years ago, he was appointed electrical engineer to Leith Corporation, and, under his supervision, the electric lighting system of Leith was instituted. He resigned the office of electrical engineer to the Corporation, and commenced a private business similar to that which he had previously conducted in Glasgow. Deceased, who was in mid-life, also devoted some attention to the development of steam motors. He was a Fellow of the Royal Society of Edinburgh.

Alexander Dawson Smith.

The death took place, on the 10th inst., at Spottiswood Seamill, Ayrshire, of Mr. Alexander Dawson Smith, formerly a member of the firm of A. and W. Smith & Co., Eglinton Engine Works, Glasgow. Deceased, who was in his fifty-eighth year, had retired from business some years ago, owing to the indifferent condition of his health. Possessed of an extensive knowledge of the practical side of engineering in most of its branches, and of great forcefulness of character, his ability and energy were widely known and recognised in engineering circles.

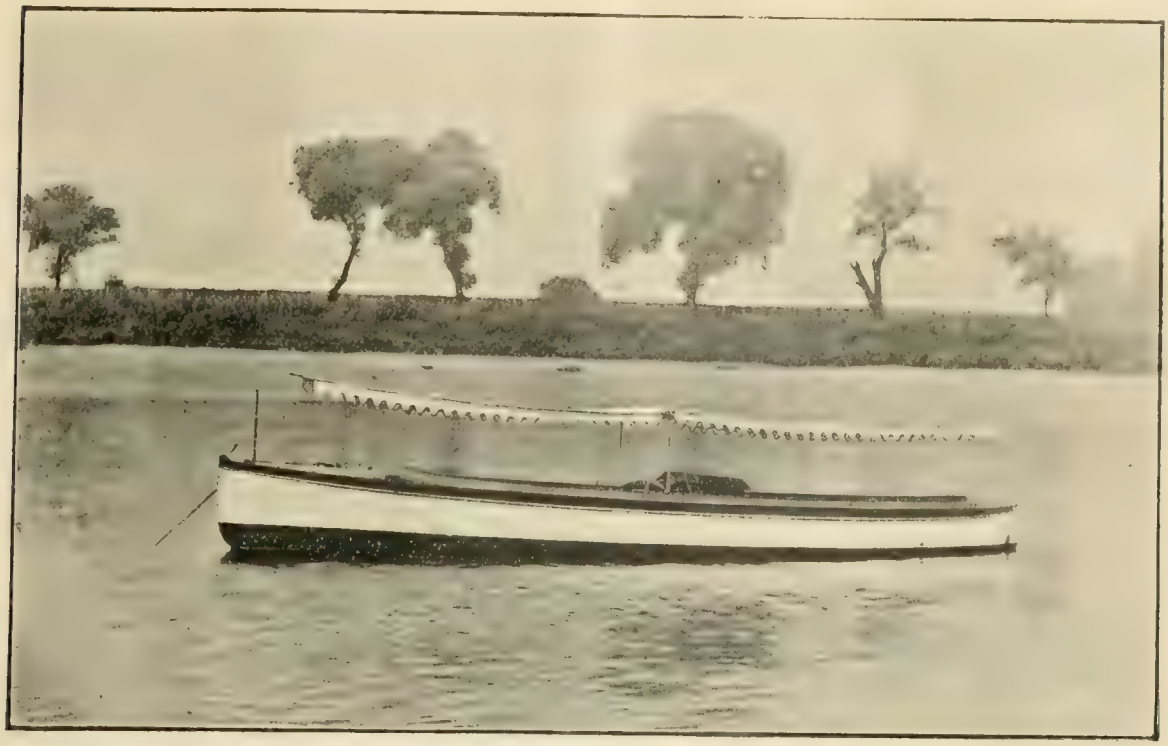


Fig. 1.—Motor-Boat, built by Messrs. John I. Thornycroft & Co., Limited, Chiswick.

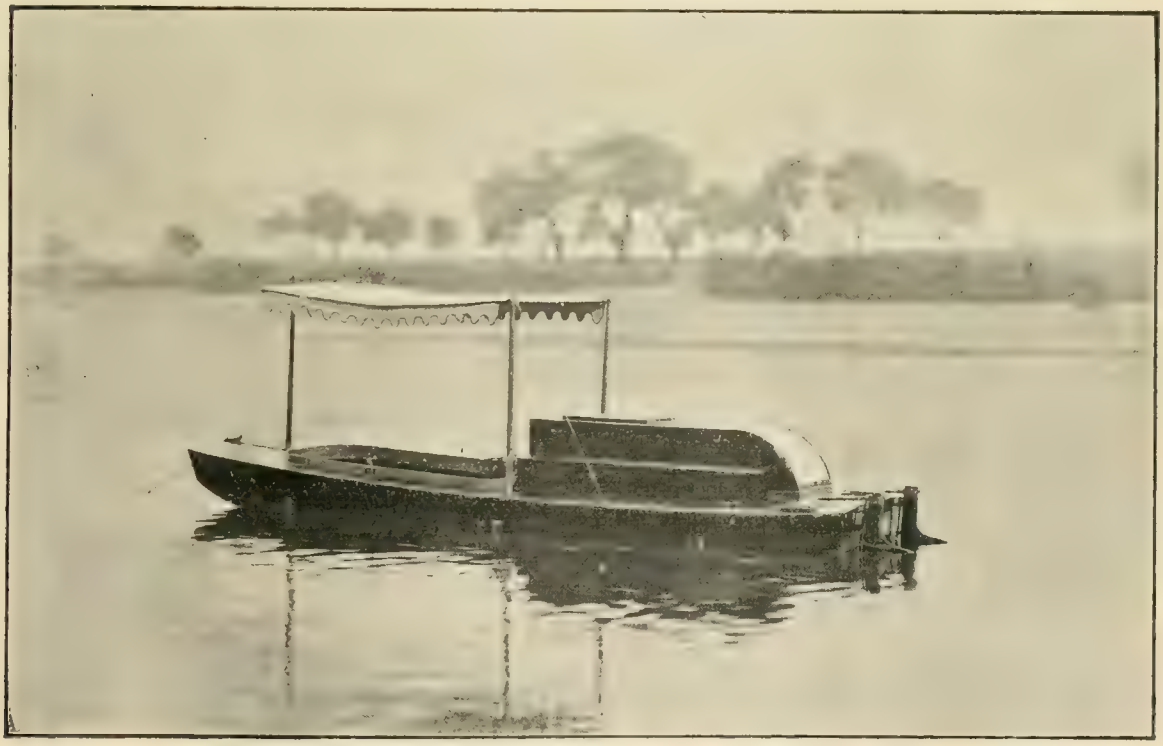


Fig. 2.—Motor-Boat, built by Messrs. John I. Thornycroft & Co., Limited, Chiswick.

THE INTRODUCTION OF CRANES IN SHIPYARDS.*

By Alexander Murray, Esq., Member.

(*Concluded from Vol. xxviii., page* 600.)

THESE cranes move along the lines at a maximum speed of about 200 ft. per minute; they raise heavy weights up to six tons at a speed of 50 ft., and light ones up to three tons at 100 ft. per minute; their turning speed at the end of the jib is about 250 ft. per minute, and the speed along the jib is about 50 ft. All motions—raising, turning, travelling—have separate electric motors, and are all controlled from the conductor's cab underneath the jib. Electricity is supplied by an underground trolley, much in the manner common to tramways, the conducting wires being led along the track in a channel close to one of the rails. Special care has been devoted to having efficient brake power, not only for working purposes but for emergencies. This type of crane has given great satisfaction, and there are now quite a number in use. The Bremer Vulcan Company, in Vegesack, have seven, three from Mr. Ludwig Stückenholz, Wetter a. d. Ruhr; two from the Benrather Maschinenfabrik Company, Benrath bei Düsseldorf; and two from the Duisburger Maschinenbau Company (late Becham & Keetman), Duisburg. The Actien Gesellschaft Weser, in Bremen, have several from the Benrather Maschinenfabrik. In Figs. 6, 7, and 8 are given photographs of those mentioned.

Comparing results of work executed by the first of those cranes to be installed, it was found that they worked out about 3 to 4 per cent. cheaper than the cantilever types above mentioned. The prices paid for the work were the same, but the men generally got ahead quicker, and finished the work in less time, thus earning more

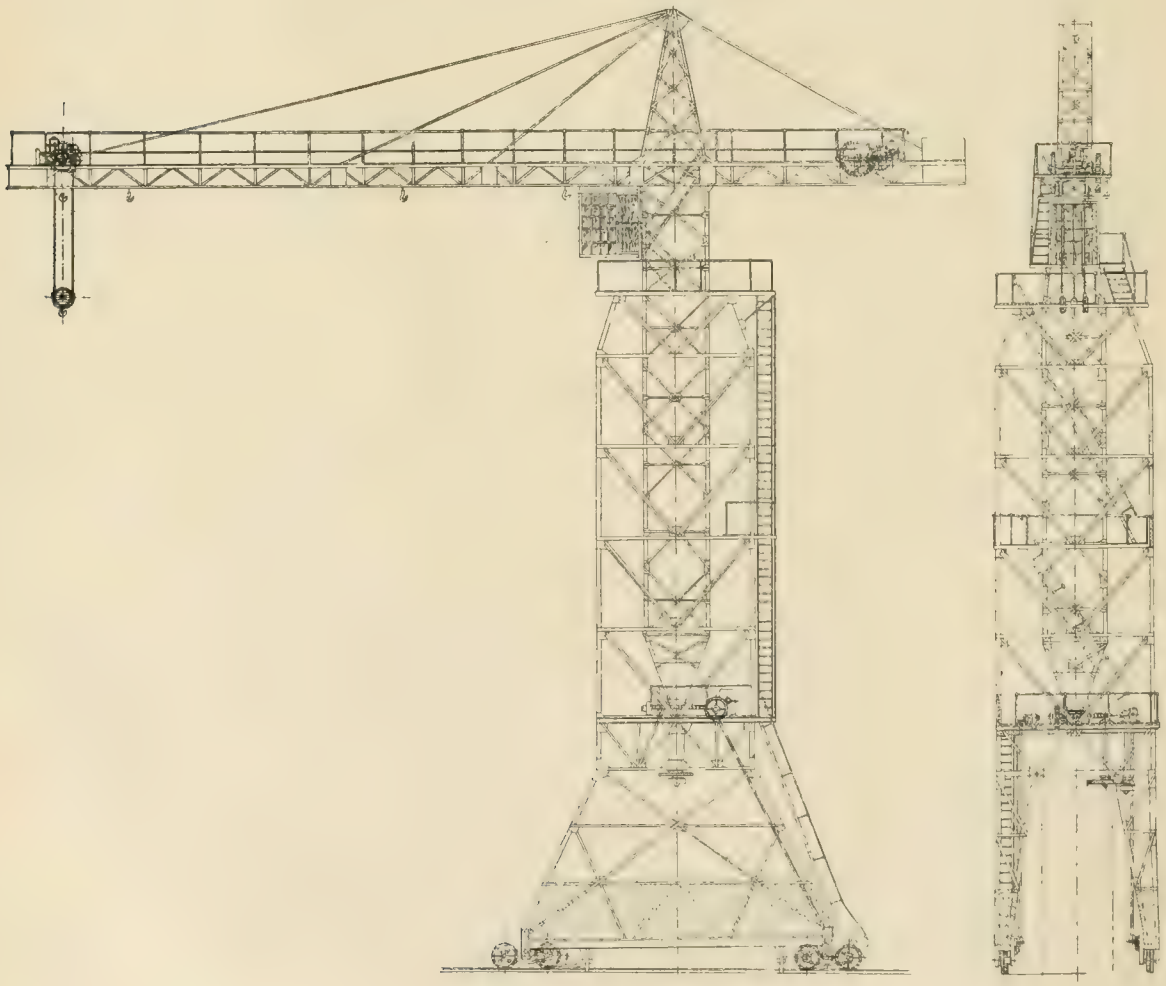
The following table shows approximately how the various types compare with one another in cost and earning capacity:—

Fig. 5.

Tower Crane built by Mr Ludwig Stuckenholz

wetter a. d ruhr.

in use in bremer vulcan shipyard



*Read at the Spring Meetings of the Forty-seventh Session of the Institute of Naval Architects, April 6th, 1906.

Type.	Cost, including Foundations.	Yearly Expense taken at 16 per cent.	Labour Saving on Old Masts or Derricks.	Gain or Loss.
	£	£	£	£
1.—Cantilever type, as described	11,500	1,840	1,720	—120
2.—Cantilever with addition of two side cranes ...	14,800	2,368	2,580	+212
3.—Lattice pillars with skeleton roof, carrying three travelling cranes over each berth ...	28,500	4,560	2,580	—1,980
4.—Lattice pillars with glazed roof, saving lost time in bad weather ...	32,000	5,120	2,838	—2,282
5.—Lattice pillars with connecting girders, carrying one large travelling crane and two side cranes for each berth ...	26,250	4,200	2,660	1,540
6.—Tower cranes, as described, two cranes per berth, equal to four cranes, and three permanent ways ...	11,900	1,904	2,660	+756

N.B.—For the sake of unity, those values have all been reduced to represent an outfit for two berths 400 ft long, suitable for vessels up to about 55 ft. broad.

The space occupied by a crane outfit is, no doubt, a great impediment to their adoption, especially in older yards, where the berths are generally close to one another. The tower type would require fully an additional 23 ft. clear of the ordinary uprights for carrying the stage planking, and would probably mean, in most cases, the sacrifice of a berth.

Other questions of great importance have to be considered with the introduction of such costly appliances. If they are to be thoroughly utilised, probably many of the methods of working should be revised, and it is not always an easy matter to persuade workmen to take up a new thing which tends to reduce the expenditure on labour. The system most commonly used in building merchant vessels, of putting up the frames and then templating all the plates, is apt to cause stoppages, forcing the machines and cranes to stand still at intervals. Putting on more squads does not always improve matters, as it will seldom happen that they will work harmoniously together. One will often have to wait till the other has finished with the crane, and continued quarrelling and discontent will be the result. It is much

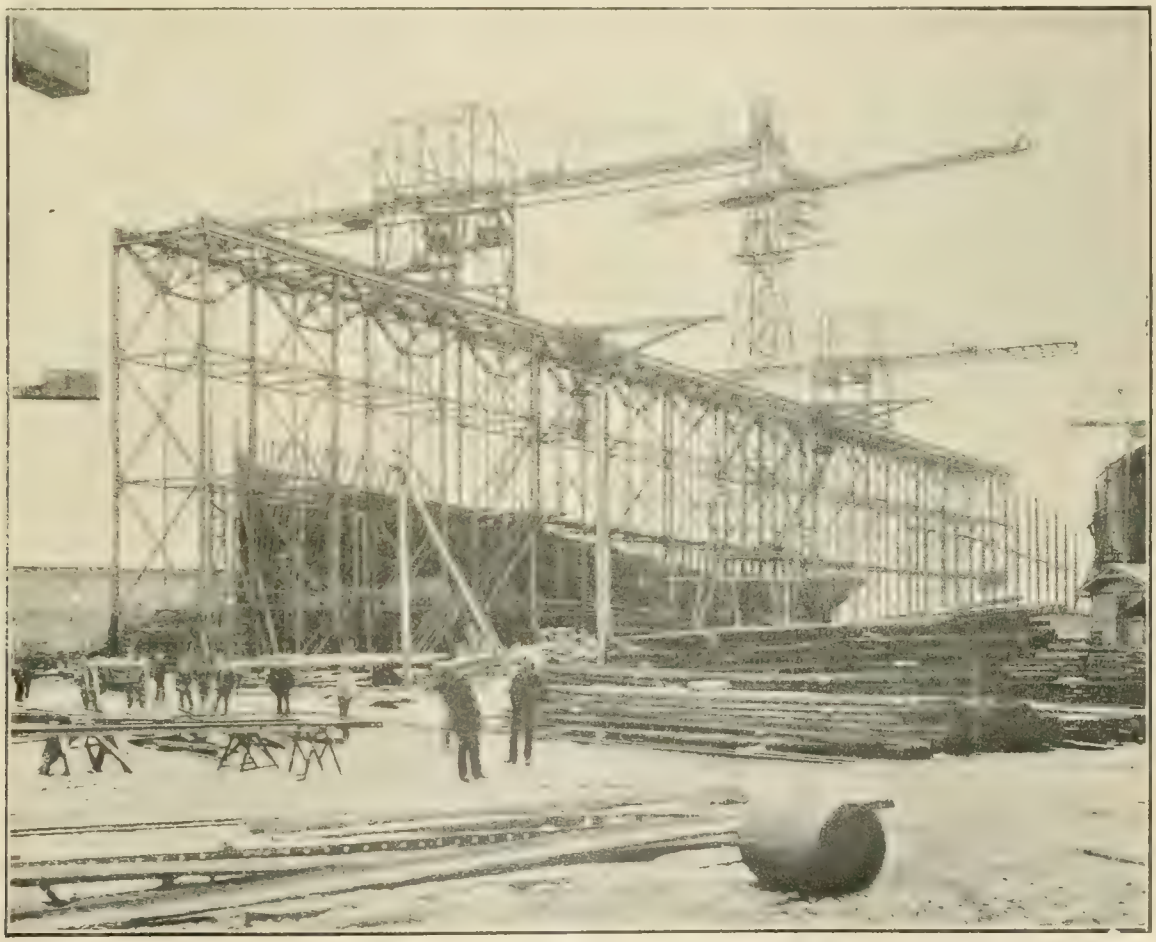


Fig. 6.—Cantilever, Side, and Tower Cranes. Built by the Duisburger Maschinenbau Actiengesellschaft. In use in the Bremer Vulcan Shipyard, Vegesack.

better to so divide the work that the squads employed in erecting will not be interrupted by marking off, templating, or any other process at all. For that reason

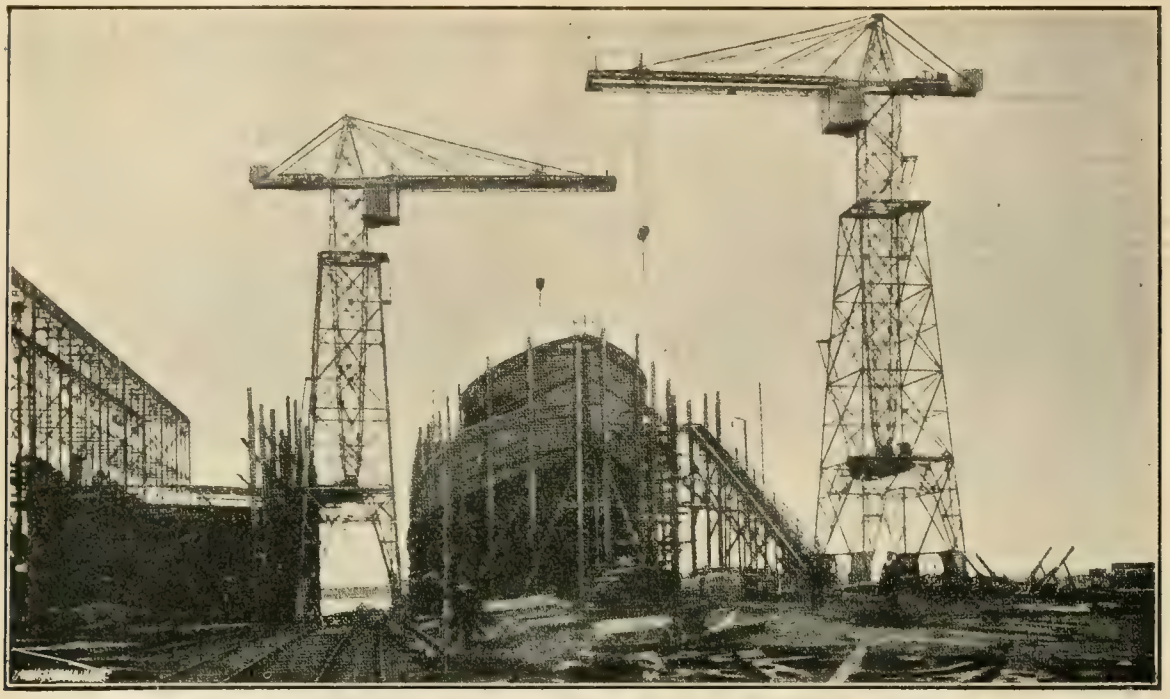


Fig. 7.—Stuckenholz Tower Cranes at Work on a 7,000 ton Vessel.

the system of laying off as many parts of the vessel as possible (commonly called the long template system) is more suitable. Many Continental, and, I believe, also American yards, practise it with good results. Where

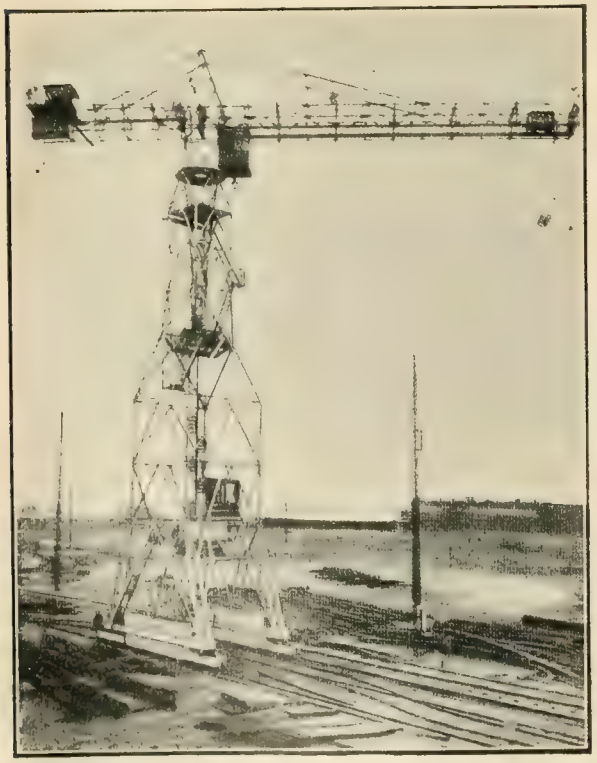


Fig. 8.—Tower Crane, built by the Benrather Maschinenfabrik, Benrath Bei, Dusseldorf.

only one vessel is ordered to one model, it may work out a little more expensive in some cases; but it has very many advantages, and, where duplicate vessels are to be built, the second turns out to be much cheaper. Considerable time is saved through the absence of ribands, the ship being trimmed into shape by the various plates themselves, with an accuracy almost impossible in the ordinary method. The present tendency is to seek economy by standardising, not only the various articles of outfit of the vessel, but the vessels themselves. A glance at the yearly reports of shipbuilding shows that the most successful firms have generally built quite a number of very similar vessels. If, therefore, a system were adopted that allows a great many parts to be made to standard templates beforehand, then, surely, it is worth introducing. Once the men are accustomed to laying off, it is not difficult to have the double bottoms, decks, margin plates, stringers, bulkheads, hatches, casings, deckhouses, and the greater part of the shell ready for mounting before the frames are erected. By doing that, the machines in the plate-sheds can be kept steadily employed almost from the beginning of the delivery of materials, and there will seldom be a lack of finished articles for the cranes to erect. As the cranes, of course, only work from above the vessel, it is very desirable to lay first the bottom plating and then build up the frames on it, so as to have as few parts as possible to mount which the crane cannot tackle easily. A great deal can be done by carefully dividing the work, so as to ensure a steady flow of material through the works. A fairly good system is to separate the machine work from the plater's work, and divide the plater squads into two minor parts. One part of the plater squad should be confined to marking off,delivering the material ready for the machine squad, and the other part do nothing else but erect. The men employed at the punching, shearing, and other machines do not require to be trained platers, and should have nothing else to do except to work the machines. The foreman, who has special charge of the machine men, must have squads of labourers to bring up the marked-off materials and take the finished articles down to the ship, depositing them within easy reach of the platers erecting.

Each manager will have to decide for himself how best

to divide the work, according to the local circumstances. It is, however, of vital importance for every shipbuilder to see that his yard is not only fitted out with the most efficient machinery for the class of work he undertakes, but to see that it is thoroughly utilised. A machine may be able to do its work very cheaply; but, if it stands half the working time, it becomes too costly in the end.

Institute of Marine Engineers.—The Saturday afternoon visit paid on July 14th by the Institute of Marine Engineers was an ideal one for a fine summer day, and the members whose arrangements admitted of taking advantage of the kindness of the directors of the Vauxhall Ironworks to visit the works at Luton, were fortunate and privileged. Luton had been *en fête* the previous day, on account of the visit of the members of the Chambers of Commerce of the Empire, and the decorations in the works and elsewhere were still in evidence, giving the outing quite a festive appearance. The outward display was quite equalled by the cordial reception accorded by the representatives of the firm Mr. Gardner, managing director, his co-director, Mr. Todhunter, and Mr. Ash, manager of the works who met the visitors on their arrival at the station, and drove to the works in motor carriages, thus giving at the outset a practical demonstration of a speciality, the manufacture of which now engages the attention of this firm, and with success; about 150 carriages, with their motors, having been made at the old works at Vauxhall, and 150 at the new works at Luton within the last three years.

Arriving at the works, the marine department was visited, where two sets of twin-screw engines, 15 in. and 30 in., cylinders with 18-in. stroke, were in the early stage of progress, including evaporating plant, electric lighting, feed, and ballast donkey pumps, and two boilers about 10 ft. diameter by 10 ft. long. The steamers for these sets of machinery are about 200 ft. long, and are being built for the contractors employed to line the banks of the Suez Canal with stone. The vessels in question are designed to carry material to be used in the construction work. From this department have quite recently been despatched a set of marine engines 13 in. and 26 in. cylinders by 20-in. stroke, and a set of twin-screw engines of 9 in. and 18 in. cylinders by 12-in. stroke, for South America. The steamer for which this was made sailed early in July; it is interesting to note that she was fitted with Yarrow's patent tunnel flap, an arrangement which admits of the tunnel being used for water ballast. On the trial trip a speed of 12 knots was attained, the contract speed being 11 knots. Our old friend, as one of the visitors termed it, the Vauxhall pump, was here in evidence, although the pumps are made mostly at the Vauxhall works.

In the hydraulic department was seen an excellent hydraulic tester, so designed that the desired pressure can be applied to suit the requirement of the job by the application of a smaller or larger ram, according to the power wanted. The special machines for the manufacture of tyres excited a good deal of interest. One machine was in course of construction to take a 12-ft. wheel 12 in. broad, with a thickness of tyre 1½ in. The object of the machine—West's patent—is to do away with the old process of heating the tyre and allowing the shrinkage to bind it on the wheel, and substitute direct compression very gradually on the wheel by means of hydraulic pressure, transmitted all round the circumference. Another hydraulic machine under construction was for compressing crucibles, accurately built and adjusted, so that the pressure and no more should be applied. The actual compression force is transmitted to the material to be compressed into shape by a ram and accumulator, the absolute pressure on the former being due directly to that on the latter, which is constant. The ram itself is worked through a system of gear-wheels and crank-shaft. The importance of the object gained in this press arises from the fact that the material used for the crucibles is deteriorated by an excess of the pressure, hence at once the Necessity, and her daughter Invention, appearing on the scene.

Motors and motor carriages were seen in all stages of manufacture, and all the details, from the axles to the ignition-gear, from the frame to the upholstered body. Aluminium has rendered possible the lightness of cases and other parts, which, made of other material, would add greatly to the weight of the motor, and full advantage is taken of this to reduce weight at even the enhanced cost of aluminium. The four-cylinder motor is preferred for steadiness of motion, and the excellent motor and carriage of 18 H.P. nominal, which works up to about 20, is a machine to be desired.

The facility with which examining and overhauling can be dealt with called for warm commendation from those whose duties call them to look for such facilities in vain sometimes, where apparently the last thought of the designer has been how to take a machine to pieces for overhaul with the least possible work. In the favourite carriage on view, the whole of the motor, its connections, cylinders, valve-gear, cooling pump and connections, brake-gear, ignition arrangement, could be inspected without bending the knee. In some cases we have had a bird's-eye view, between the heads and shoulders of the gathering crowd, of the driver down on his knees, worshipping the demon *under* the car. Perhaps the fact that a marine engineer has the active management of the Vauxhall Ironworks has had something to do with the insistence of this feature of overhauling and examining being kept in front.

The last place visited was the drawing office, turned for the nonce into a tea board-room, where, after partaking of tea, a few words of welcome were given by Mr. Gardner. In the course of his remarks he referred to the extremely healthy surroundings of the works, the purity of the atmosphere, and the strength of the straw—the local industry being well known as the making of straw hats, while to America are shipped in large quantities straws for Brother Jonathan's drinks.

Mr. W. C. Roberts proposed, and Mr. E. W. Ross seconded, a vote of thanks to Messrs. Gardner and Todhunter, and to Mr. Ash and his staff, for their kindness in showing them over the works. The visitors were then grouped into motor carriages, and led off by Mr. Ash, a procession was formed for a run of fifteen miles to St. Albans, with a visit to the fine cathedral, and at St. Albans the motor carriages were changed for the train to London. It was whispered that on the way to St. Albans the speed exceeded that of a train; but it was not clear whether the whisper was cynical, and referred to any particular train or railway, or to the speed and celerity with which the motor carriages were worked; and it was marvellous. Suffice to say that one or two policemen were passed—at a moderate speed—and no protest was made, so that we may take it that everything was in order. So closed a most delightful afternoon, which will live green in the memory of those who were present for the treat they enjoyed, and in the memory of those who were absent for the treat they missed.

REVIEW.

The Geometry of the Screw Propeller. By W. J. Goudie, B.Sc. London: Blackie, Son, Limited. 1906.

The author prefaces his remarks on the above subject by saying he intends them mainly for students in technical schools. The propeller has always a certain amount of fascination, owing to the peculiarity of the problem involved, and here, when the author essays to simplify the details attending on the matter, he is likely to find readers who will join with him. His methods are graphical, as might be anticipated; and, after giving the general principles of the geometry of the propeller, embracing pitch, diameter, surface, mention is made of the shop conditions required, and the fact stated that these are in the main a vertical spindle fixed in a foundation plate, and a loam board for tracing out the screw surface. The process is, however, shown in cardboard or other model form. This is obviously very convenient for the purpose intended, as it is rightly observed that very few students have the opportunity of carrying out operations in a foundry itself: In all these experiments shown, however, the actual practice in the foundry is distinctly kept in view. Having given the fundamental principles, and shown their development, the author then considers the preparation of a drawing. It is clearly shown, both from the practical and theoretical standpoints, how to project the different views of a propeller to satisfy the most critical judgments, till the screws, both right and left hand, with true and varying pitches, are found, with figured dimensions. The latter are given, both with radial and axial increasing pitch, separately and combined. We think the author has given, in a moderate compass, all that can be said upon the subject, and that for teaching purposes the book is sure to meet a want.

THE ELECTRICAL EQUIPMENT OF CLYDEBANK SHIPYARDS.

THE party of foreign electrical engineers, who recently made a tour through many of the chief cities of industry in England and Scotland, as guests of the Institution of Electrical Engineers, visited, while in Glasgow, the renowned shipbuilding and engineering works of John Brown & Co., Clydebank, where very interesting information was afforded them of the steps by which the present very complete installation of electricity for both lighting and power have been arrived at.

The application of electric energy to the lighting of this shipyard and marine engine works was commenced in the early days of the commercial use of electricity, a few belt-driven dynamos being installed working arc lamps on the well-known brush high-tension series system. A few years later, a further development was undertaken in the temporary lighting of ships under construction with incandescent lamps working off a two-wire system at 110 volts. The power required for this temporary ship lighting is furnished by direct-coupled Siemens and Crompton dynamos, the engines being of Willans and Belliss high-speed compound type. The total power available for this work, and also for the lighting of a small portion of the shipyard, is about 400 kw. The whole of the brush arc lighting system, and practically the whole of the 110-volt system, as applied to the lighting of offices and shops and driving of motors in the shipyard, has within the last year been superseded by a two-wire system at 220 volts. This change has been carried out with the object of centralising the whole of the power plant in one station in the middle of the engine works. This more modern station was commenced about twelve years ago with two 44-kw. rope-driven compound dynamos, the power being obtained from Crossley gas engines. This plant was from time to time increased by the addition of further rope-driven dynamos, three being of 77 kw., and two of 177 kw. With the further extension of this station, the Dowson producer plant, using anthracite coal, was done away with, and a large Mond producer plant, with sulphate of ammonia recovery, has been installed. The gas generators are 10 ft. in diameter, each capable of gasifying sufficient bituminous slack coal to maintain engines of 2,000 H.P. The plant at present consists of five of these generators, with space for further additions. Besides supplying the electric power plant, the gas is utilised for firing boilers, for steam hammers in the engine works smithy, for heating furnaces for working beams and angle bars in the shipyard, and for similar other purposes. The latest addition to the power station has been four 300 kw. 220-volt, shunt-wound Lahmeyer dynamos, running at 140 revolutions per minute, and direct coupled to 500 B.H.P. two-cylinder scavenging-type tandem engines of the Premier Gas Company's manufacture. The total plant capacity of this central station is 1,900 kw., and it is intended to ultimately displace the whole of the steam-driven plant already mentioned by further additions to this gas-driven station. Besides these two centres of electric supply, another plant, consisting of four units, aggregating 240 kw., are situated in the large and up-to-date sawmill placed at the extreme end of the establishment. These dynamos, which are belt-driven, absorb the surplus power of a slow-speed, horizontal compound Corliss valve engine, installed for driving the main machinery of the sawmill. These dynamos, besides lighting and driving overhead travellers in the sawmill, also supply light and power to a large ironworkers' shed.

The total plant capacity installed throughout the establishment is a little over 2,700 kw., or 3,600 electrical H.P. The distribution mains are almost wholly lead-covered paper-insulated concentric cables, carried along walls or through a large underground conduit, extending about a quarter of a mile along the engine works front. A considerable number of cables, steel-armoured and further protected by loose planking, are laid underground. These cables vary in size from 0·15 to 0·6 square inch in section. The lighting of the shops and roadways is very largely by means of arc lamps, both open and enclosed, there being about 430 of the open and 280 of the enclosed type, making a total of 710 arc lamps. Of incandescent lighting, there is a load equivalent to 4,000 16-C.P. lamps. Lighting by enclosed inverted arcs has been adopted in the drawing offices, and has given much satisfaction. Although the whole of the establishment has not yet been converted to electric driving, a gradual process of conversion is going on, so that at the present time the entire machinery in the engine works is now driven by electric motors, as is also a large proportion of the shipyard plant. The motors are of all sizes, from 125 H.P. downwards. The aggregate B.H.P. is 4,840, distributed over about 300 motors. Motor driving has been adopted to almost every kind of machine tool, cranes, pumps, and other appliances to be found in a shipyard and engine works. Among the heavier uses to which it has been put may be mentioned a set of high-pressure hydraulic pumps, requiring a motor of 125 H.P. The pumps are belt-driven, and have fast and loose pulleys, with belt-shifting gear, actuated automatically by the rise and fall in the hydraulic pressure. There are a large number of three and four-motor cranes, of lifting capacities of from fifteen to sixty tons, large machine tools for boring and turning turbine rotors and casings, requiring motors of 40 and 60 H.P.; plate-bending rolls direct-geared to series wound reversing motors, fitted with electro-magnetic brakes; two motors of 80 H.P., and one of 90 H.P., each driving by belting an air compressor supplying air at 80 lb. pressure, to the machine shops, foundry, &c., for pneumatic drills, chipping and caulking tools, and various other purposes. There are at present being erected on each side of the fitting-out basin two giant electrically driven cranes. The one situated on the west wharf is of the hammer-head cantilever type, the other, situated on the east wharf, is a derricking jib crane, and both are capable of lifting 150 tons. Several winches, capable of exerting a pull of twelve tons, are placed round the fitting-out basin for shifting ships in dock.

Among the more special applications of electric power may be mentioned an electric annealing plant for locally softening the case-hardened surface of armour plates, for the purpose of enabling holes to be drilled in the plates after they have been erected in position. The annealer consists of a specially constructed transformer, the secondary winding being a heavy hollow copper casting in the form of a horse shoe, with feet about 4 in. apart. The part of the armour plate to be softened completes the electrical circuit of this secondary winding. The primary, contained inside the casting, consists of about 100 turns of copper strip, and receives a single-phase alternating current of 100 ampères at 300 volts. The passage of the induced low-pressure current through the secondary coil and the armour plate heats the latter, and by slowly reducing the current after sufficient heat has been obtained, the surface of the plate between the feet of the annealer is left in a softened condition, capable of being bored. Another special application is the driving of the model carriage in the experimental basin, which is the only one in this country to be electrically equipped. In order to obtain an absolutely steady pressure of supply, current is obtained from a battery of 120 storage cells, which supplies power to a continuous-current transformer, the generator portion of which has its field separately excited and under control from the travelling carriage. The two motors driving the carriage can obtain current at any pressure between 20 and 220 volts, corresponding to speeds of from 110 ft. to 1,200 ft. per minute. Absolute uniformity of speed over the whole run of about 400 ft. can be obtained in this manner.

In addition to the temporary lighting of ships under construction considerable use is made of electric power for driving portable drilling machines and grindstones;

winches for lifting plates, bars, and other material; centrifugal pumps for cleaning out bilges; machines for facing up roller paths in 12-in. and 9·2-in. gun barbettes, and various other purposes. The total output of electric energy averages about 2,500,000 units per annum. In addition to laying down and maintaining the above-mentioned plant, the electrical department at Clydebank carries out all contracts in connection with the permanent fitting out of electrical installations on board ships; the plants varying in size from dynamos of 5 kw., required for small paddle steamers, up to installations of 1,500 kw., supplying light and power to 5,000 incandescent lamps; motors of all sizes, from 50 H.P. down to 1 H.P. for cranes, winches, boiler-room fans, ships' ventilating fans, passenger and goods elevators, heating and cooking apparatus, bells, telephones, and all the other varied applications of electricity to be found in the largest Atlantic liners, battleships, and cruisers.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

IN view of the large sums of money being spent at the present time on technical training, most of which is disbursed from public funds, it behoves everyone to closely scrutinise what is obtained for these payments; and with reference to the department with which we are concerned, we find that, to be really up to date, it is possible to go into considerable sums by way of plant for demonstrations alone, apart from the building and site. The heavier pieces of machinery require to be put in place after being lifted for examination; and obviously a travelling crane overhead facilitates operations. This will be electrical, with its motors arranged for the various calls of travelling, traversing, and hoisting. If there are any galleries, these may be served by small trolley travellers. The workshop will contain machine tools and motors for undertaking work required for the purpose of demonstrations, if it may be advantageously done on the premises. The main driving plant is likely to be located in a separate building, to facilitate laboratory examinations, and separate the two functions of generating power and utilising the same entirely. A prominent feature is naturally the lecture hall, with its projecting screen, for giving lantern views. A standards laboratory is required for calibrating and standardising instruments, if this may be attempted. Switch boards will be situated so that the lecturer can control any circuit he pleases. A library is likely to form an important section of an institution of this kind; but the apparatus and general arrangement varies according to the prominence intended to be given to any particular trade or class of student, it being obvious that though you may not be able to teach technically without demonstration, still the apparatus must apply to the purpose in view, or the student will receive a smattering of education with no knowledge of any particular branch of the same, which, we are afraid, is the fault of most teaching of this kind to-day, and which brings it into disrepute generally. The difficulty of direction is so great, the diffusiveness of education being almost as serious as its absence, from a utilitarian point of view, we are afraid.

With the rapid developments taking place in connection with wireless telegraphy, few of which are published, we only obtain scraps of information, but what we do get seem to indicate that fixity is being arrived at, as regards tuning, if we may use the term in a general sense to mean delivery and reception by two instruments, and these alone, whatever the method adopted may be. It is a question of frequency. When that requisite is received, one leg of a circuit only is affected. In this circuit is a condenser, with a capacity different in a small degree from another in the same circuit. Oscillations are produced continuously, and signals, by varying the frequency, which is done by short-circuiting and open-circuiting, a single turn of wire, held by a spring, the Morse code, of course, being used. The balancing of the circuit in the way described enables a message to be received from a transmitter only of the same frequency, and any other messages that are being forwarded in the immediate neighbourhood, only have the effect of a continuous hum on a telephone or pulling the needle of a receiver over, but the station receives no signals. What ever the variation of detail may be, we think it will be found that this is the general principle this class of apparatus is being worked upon, and which we know, from recent reports, has been made a success. Without some such success, the system would probably have been much more restricted in its usefulness than it is now likely to be. The subject is, therefore, one of supreme importance.

In this connection the question of wireless telegraphy came before the House of Commons again, after the amendments made in the House of Lords, and an assurance was given by the Postmaster-General that any system by which improvements were possible would be welcomed by the department, and that no monopoly was intended to any particular company by the present Bill. It is to be noted that communication has just been established by the Marconi Company between Australia and Tasmania, and the inauguration of the system was the occasion of some considerable demonstration, as the first messages were despatched between the Governors of the Colonies concerned. That, however, cables are by no means defunct, we have the fact that no less a fleet than fifty-three steamers are employed in the laying of cables. These vessels aggregate 95,000 tons, with 25,000 H.P. Of the total number, Great Britain owns thirty of these, France apparently coming next, with six. Even the Chinese are, however, adopting the new system, and the Government has set up several stations, while native operators are to be instructed. Four vessels of the Navy are also being fitted with Marconi apparatus at Shanghai. In the text of the agreement between our own Admiralty and the Marconi Company, the former will have the command of the latter's stations, practically as required, during the length the agreement holds, and facilities will be afforded by the company for the instruction of naval operators at any of the company's stations. An increase in the number of these in Canada, and facts of a like character, point out clearly that one company at least has this business very strongly developed in many parts of the world, the aim being evidently primarily for communication between ship and shore.

THE SCREW PROPELLER CONTROVERSY.

IN continuance of the subject of the elaborate paper by Mr. James Howden, on "The Screw Propeller Controversy," read before the Institution of Engineers and Shipbuilders in Scotland, which we reprinted in full in our issues for March 2nd, 9th, 16th, and 23rd, we have now pleasure in giving, in this and succeeding issues, a reprint of the author's reply to the various criticisms on his paper by members of the Institution. Mr. Howden, in his thorough fashion, makes it quite clear what the criticisms consisted of, as well as giving no uncertain sound in the terms of his rejoinder. Mr. Howden said that to those members who had honoured his paper with their criticisms, he had to confess his regret that they had not followed his request to study first the vital parts of the paper, viz., the demonstrations (1) of the actual movements given to the water by the screw in propelling, and (2) of the erroneousness of Professor Rankine's and all analogous theories. If this advice had been followed, he felt assured these criticisms would have been very different in character. A geometrical proof was absolute, it did not admit of being partly right or wrong. So were quantitative proofs based on actual measurements, quantities, weights, and velocities. If such proofs were submitted in support of any statement in geometry or mechanics, nothing was more easy than to show their incorrectness if such existed. He had submitted proofs fully worked out, both as to what was right and what was wrong, in this, as in his previous papers on the propeller's action, yet not one of those who had opposed his views had, during these twenty-eight years, ever proved against him a single error. After waiting in vain all these long years for any such proofs of error, he could not fairly be accused of undue haste in claiming his demonstrations to be unassailable. Notwithstanding these facts, at no former discussion of his papers on this subject had it been attempted, as in this discussion, to upset his demonstrations by narrations having no bearing whatever on the vital questions at issue; by assertions of errors made without the slightest supporting proof; and by the reiteration of the opinions and statements of writers on the subject which his demonstrations had proved, beyond

cavil, to be entirely incorrect. It was certainly strange that all those mathematicians and experts who opposed his views on the propeller should suddenly lose their knowledge of geometry and power of delineation and calculation when asked to put their objections to his geometrical proofs and calculations in similar form, and should begin to argue about assumed motions of water given by the propeller, motions they never attempted to prove, this being impossible as such motions did not exist. He would here ask his honourable opponents on this important subject if it was fair, if it was even admissible in the discussion of an entirely mechanical subject like this—capable of being accurately delineated, geometrically analysed, and reduced to dimensions—to altogether ignore the demonstrations he had given of the real action of the propeller. These demonstrations, supported as they were by what purported to be absolute proofs, could only in fairness be denounced or rejected after they had been proved wrong, and that, not by unsupported assertions, however strong, but by definite geometrical and quantitative proofs, such as he had used in support of these demonstrations of the propeller's action. He submitted that no other method was in fairness admissible to any opponent. If any such could prove his statements wrong in this, the only legitimate way, he was prepared to make the fullest apology for what would then be his persistence in holding as right what had been proved to be wrong. But until such proof was forthcoming, he must necessarily hold that he had absolutely proved in these papers the real and only actions the propeller could make on the water under any given conditions. Before referring to the individual criticisms made in the discussion, it would, he believed, save some time and space if he first noticed some points which seemed to be held more or less in common by several members who at the same time objected to his views. He would class these as follows:—

(*a*) That his geometrical demonstrations of the true action of the propeller might be correct so far as they went, but did not appear to go far enough, and stopped short of a complete theory.

(*b*) That his methods if carried further would probably yield results identical with Rankine and Froude, and that the only difference between Rankine and himself was the quantity of water moved, the rate of the movement in both cases being the same.

(*c*) That he neglected the hydrodynamical effect of the propeller, which effect was said to be so important as to make all other demonstrations of no value.

(*d*) That he neglected the effect of the centrifugal action of the propeller.

(*e*) That he forgot that the views of Froude and Barnaby were founded on actual experiments.

(*f*) That he neglected or controverted Newton's three laws of motion.

Though the explanations given in this and in his previous papers should have rendered it unnecessary, he would, to prevent, if possible, further misunderstanding, take up, so far as his time would permit, each of these points again. *Firstly*, he would remind those who considered that his demonstrations did not go far enough and stopped short of a complete theory, that he claimed to have absolutely demonstrated geometrically and quantitatively, by means of the seven geometrical propositions and their application to an actual screw of given dimensions, how the exact extent of all its motions could be absolutely ascertained for any propeller under all the varying conditions of dimensions, shapes of blades, pitches, slips, and revolutions. His geometrical analysis proved the exact movement given to the water by every circumferential line on the blade under every possible variation of conditions. These demonstrations covered completely every movement of the screw in itself and its action on the water in propelling, and showed further how all these movements by any given screw could be graphically represented and absolutely calculated numerically. When all these movements were known, nothing remained unknown about the action of the screw propeller and no further theory was wanted. The word "theory" had here evidently been conceived as containing some intrinsic value in itself, over and above that due to demonstrations which gave complete knowledge of all the correlated facts, that was, all the phenomena connected with the screw's propelling action. The term "theory" was generally used or applied to phenomena, some parts of which, at least, did not admit of absolute proof, but were, for reasons given in the theory, most likely to be correct. Statements regarding the action of the screw propeller when fully demonstrated, as those in this paper, and understood, as all mechanical action should be, got beyond the region of theory into that of absolute knowledge of the important facts desiderated. It appeared to be necessary to mention here that this paper and those of 1879 and 1890 were limited to the consideration of the propelling movements of the screw. But his papers of 1877-78 also included the important consideration of the effect of the displacement of water by the body of the propeller. For the complete action of the screw the displacing movements as analysed in these papers should also be studied as these movements were quite distinct from the propelling movements. What he had not attempted in these papers was the formulation of rules to calculate thrust from compression of the water by slip, as he considered such as inapplicable for this purpose, as they would be for calculating the thrust from the wear on the shaft collars and thrust rings in the thrust block. Nor had he considered the effect of friction in these papers, not because it was unimportant, quite otherwise, but because it could not be ascertained without elaborate and expensive experiments. The only reliable way to find the thrust effects of different slips, under an equal power of engine, was by the use of a proper dynamometer, which could without great cost be easily applied to ships of 500 or 1,000 I.H.P. His analysis also provided for the exact calculation of the effect of the wake and of its varying effects at different depths whenever these different velocities were ascertained. He therefore held that his investigation of the propeller's action covered, with the above necessary limitations, all the movements any propeller could make. *Secondly*, those who thought that his methods if more fully worked out would probably be found to coincide with Rankine and Froude, showed what great confusion of mind existed as to the real action of the propeller and how little his demonstrations of this action had been comprehended even by those who wrote on the subject. Those who so spoke showed they had no proper conception of the *rationale*, either of his demonstrations or of the Rankine theory. Admitting as they did the correctness of his demonstrations "so far as they went," they gave their whole case away. If his demonstrations were correct then no other conclusions which differed from them could be correct. His conclusions rested entirely on geometrical proofs, the correctness of which could be examined. These showed that, the extent of the motions given to the water by the propelling face of the blade of his example propeller, at its extreme and most effective diameter, was ·82 in. when making 10 per cent. slip. By the Rankine theory the movement given to the water by this propeller at the same diameter with the same slip was 27 in.! No one who was convinced that the sum of the angles of any triangle was equal to two right angles could ever be led to believe by the strongest assertions that though in some cases this might be so, yet in some other triangles the sum of the angles might be equal to three or four right angles; nor was it possible that those who were convinced that two and two made four, would ever be persuaded by even the most plausible rhetorician that though these two sums together made four in ordinary calculations, yet in some calculations, such as those connected with the mysterious movements of the screw propeller, they might make five, or even ten. Not one bit less absurd and incongruous were the ideas that, if he carried his demonstrations far enough, they might be found to harmonise with the views of Rankine and Froude. The only point in common between the Rankine theory and the facts regarding the action of the propeller brought to light by his geometrical analysis, was that of the extent of the difference between the slip of the screw and the slip of the water *per revolution*. He called special attention to the agreement being limited entirely to the slip *on the whole revolution*, for what he proved to be actual slip made during the revolution as found by Props. 6 and 7, Professor Rankine assumed as being made from beginning to end of the revolution, which was a vital mistake. He had again to call attention to the crucial fact which distinguished and separated these demonstrations from all others on the motions imparted by the blades of a propeller, which was the division of the total slip of the water *per revolution* by the number of times the arc of the circle across the face of the blade at any given diameter divided the distance travelled by the blade in one revolution at that diameter. This gave the only true key to the solution of these propeller problems, and showed all other estimates of the movement of the water to be egregiously wrong. Even at

100 per cent. of slip, where the Rankine theory would at 20 ft. diameter of this propeller give the movement of the water as 25·4 ft. per revolution—his analysis showed that the total movement imparted to the water by the blade at this diameter was only 8¾ in. This movement, of course, increased towards the root of the blade, on account of the increased breadth of the blade, its increased angle, and the reduction of its diameter. With the vessel remaining fixed in one position would, of course, set up a continuous stream, but if the blade were reduced one-half in breadth the movement of the water per revolution at 100 per cent. slip would be reduced one-half also, and so on in proportion until, even with this slip, the movement of the water would scarcely be observed. These facts proved that the extent of the movement of the water was governed by the breadth of the blade, a fact entirely left out of account by all other writers on the screw propeller. The Rankine theory required for his example propeller at 10 per cent. slip a column of water 25 ft. in length + 2·24 ft. added thereto by slip, in all 27·24 ft. in length, and detached in some unexplained manner from the surrounding water that it might be thrown in a mass each revolution 2·24 ft., in order to obtain the necessary thrust reaction as calculated by the $\frac{Wv}{g}$ formula. He had in all his papers already dwelt sufficiently on the impossibility of this motion that he need not go over the same ground again. It would suffice to repeat that whatever extent of motion was given to the water by the screw it was a *uniform motion*, and not given by one impulse, or accelerated, so that the formula $\frac{Wv}{g}$ would not apply even if the column existed, as only the friction of the moving column would then constitute the resistance. As a basis for calculating the reaction of the propeller, all columns, vortices, &c., were entirely inapplicable. As his demonstrations of the true action of the propeller proved that the phenomena they established were as far as the poles asunder from those on which Professor Rankine's theory was based, it could no more be admitted that the latter were also correct, than that it could be admitted that though two and two made four generally, in some cases they made five or ten. *Thirdly*, The hydrodynamics of the propeller. From the special references made by some members to this branch of science, they seemed to consider it something mysterious and esoteric, known only to the initiated, and that his presumed lack of knowledge of this science rendered his demonstrations of no value whatever. As mysterious science was a contradiction in terms, he trusted he might, without irreverance, say, that after all what these critics referred to was merely the movements made on the water by the blades of the screw in propelling. The displacement of the water by the body of the blades and boss might also be taken into account, though it was the propelling movements which were really in the minds of these critics, the very actions about which all his latter papers had been written. He had flattered himself that he was the only writer on the science of the propeller who had shown its true hydrodynamical effect, though these critics doubted his having any knowledge of this science. They evidently had in their minds some grand movements of water, such as the Rankine column, rotating as some (though not Rankine) had it, or the grander conception of Mr. Rigg, which they considered necessary to account for the reaction by which the ship was driven forward. As he had mentioned in his paper, it was the impossible hydrodynamics of Mr. Arthur Rigg which first led him to consider the true action of the propeller. These, as conceived by Mr. Rigg, were on a royal scale of magnificence. Mr. Rigg's views were received with much acceptance at the Institution of Naval Architects and other Institutions when read about the year 1868. In his (Mr. Howden's) paper, read before the Institution of Naval Architects in 1890, he made some critical observations on this theory where they could be examined, page 252, Transactions of the Institution of Naval Architects, Vol XXXI.* Suffice it to say here that, according to Mr. Rigg's theory the blades of his (Mr. Howden's) example propeller at 10 ft. 3 in. diameter would, independently of slip (which he never mentioned) throw the particles of water with which they came into contact all round the revolution, a distance from the propelling faces of not less than 42 ft.! Certainly to such as considered such grand backward movements of the water as absolutely necessary to ensure a grand forward movement of the ship, his small retrogressive movement of one or two inches of water must appear ridiculous. It was true, nevertheless, and the opposite untrue. A large backward movement of water, that was a large slip, meant a small forward movement of the ship. As this backward movement increased, though equal power was expended, the forward movement correspondingly decreased. This was, of course, all against the authorities, but all so much the worse for such authorities. Though it involved excessive repetition, he must reiterate that his analysis geometrically proved the real hydrodynamics of the propeller, and at the same time the impossibility of any such thing as a screw "race," "column"—rotating or otherwise—"vortices," "centrifugal action," &c. (which had hitherto occupied so uselessly, or, rather disastrously, the minds of professional experts) being produced by the propeller's action and reaction under ordinary conditions of working. For still further illustration, take again the example propeller at its extreme diameter, where the propeller face of the blade, during a movement equal to its own breadth, only moved the water against which it pressed ·82 in. It must also be noted that that ·82 in. was only completed at the end of the movement by the last point in the blade, the mean movement of the water across the blade at this diameter, at any given instant, being one-half, or ·41 in. Another notable fact was that the blade, at this diameter, at 10 per cent. slip, passed through a distance of 67·62 ft. in one revolution, and at any given instant was *only acting on the water across its own face, and nowhere else*. As this face was only 1·37th part of the distance passed over, the remaining 36 parts, *or fully 97 per cent. of the revolution remained unacted on*. Further, each particle of water touched by the blade had only been in contact with it 1·37th part of a second, and had been moved ·82 in. at a *uniform velocity*. The flat propelling face of the blade only glided over the water face of the nut. The slip movement began as quietly as it ended, the movement of the water by the first *inch* of the blade being barely 1·28th part of an inch, so that no impulse or blow was given to the water by the blade, and likewise no time, so to speak, for the water to yield to pressure. Then as the body of the blade left an empty space behind it, any sternward or angular movement given to the water against which the blade had pressed was extinguished by that water faling into this space. These important facts being fully understood, there was no difficulty in comprehending how the reaction of the propeller was obtained with the slightest sternward movement of the water.

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* "This theory (Mr. Rigg's) has, however, evidently impressed many minds with some remarkable notions of the behaviour of the water within the 'sphere of influence' of a screw propeller, and along with some of the views of the late Mr. Robert Griffiths, appeared to have risen to such ideas and expressions, now continually appearing in screw literature, as 'reverse currents,' 'screw race,' 'feeding the screw,' 'water passing into or through the screw,' 'screw spinning a rope of the wake,' 'rotation of the race,' &c. Some of these expressions seemed to rise not only from the idea of a great twisting and elongated motion being given to the water by the propeller, but also from the further idea of the propeller working without forward movement—in a partly inaccessible place, where the reluctant water was sucked and dragged into its embrace as into a turbine wheel, and after being whirled round for an indefinite period was thrown off sternward or angularly in a grand revolving current equal or nearly so to the area of the screw's dics." Mr. Froude used frequently such expressions as "water passing into or through the screw," "rotation of the race," &c. The water had no tendency whatever to pass "through the screw." It was the screw that passed through the water. If the ship was going against a strong current, the current would *assist* the turning of the screw. If, on the other hand, the current were running with the ship the effect of this following current was to *retard* the turning of the screw, the resistance to the turning of the propeller blades being increased thereby. He might add here that the almost universal idea of a body of water, called a "race," being driven astern at some velocity by the action of the propeller was entirely illusory. What so appeared to those who spoke of a "screw race" arose doubtless from the forward movement of the vessel *leaving* astern the commotion caused by the rapid displacement of the water by the bodies of the screw blades. This apparent sternward movement, or "race" as it was erroneously called, did not *recede* from the vessel. It actually followed it to some extent under the influence of the wake.

(*To be continued.*)

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from July 10th to 24th, 1906:—

Engineer-Commanders.—W. H. Adams, to the *President*, for service in Controller's Department, as Engineer Inspector of Gun-Mountings; A. C. Darley, to the *Brilliant*, to date July 9th; W. J. Hender, to the *Pembroke*, additional, to assist engineer manager Chatham Dockyard in connection with machinery of submarines, to date August 5th; W. Hines has been promoted to the rank of Engineer-Captain, with seniority of June 22nd; C. Mck. Norris, to the *Resolution*; J. W. A. Parrott, to the *Cæsar*, to date July 14th; G. Pascoe, to the *Charybdis*, on recommissioning, to date July 21st; J. J. G. G. Percy, to the *Nile*, to date July 14th; J. M. Simpson, to the *Thetis*, re-appointed on recommissioning, to date July 14th; T. D. Thomsett, to the *President*, additional, as Engineer Overseer, Newcastle-on-Tyne, to date July 24th; A. W. Turner, to the *Vengeance*, to date July 14th; H. Wall, to the *Juno*, to date July 10th.

Engineer-Lieutenants.—J. H. Barber, to the *Sapphire*, for the *Cheerful*, to date July 10th; C. W. Bolt has been promoted to the rank of Engineer-Commander, and re-appointed to the *Pelorus*, to date July 1st; V. A. Brook, to the *Prometheus*, on recommissioning, undated; E. Carter, to the *Alacrity*, on recommissioning, undated; E. W. Chamberlain, to the *Sapphire*, for the *Eagle*, to date July 13th; L. R. Croisdale has been advanced to the Senior List, with seniority of July 1st; F. C. Dans to the *Æolus*, to date July 24th; R. B. Davies, to the *Alacrity*, on recommissioning, undated; H. Evans has been advanced to the Senior List, with seniority of July 1st; S. M. O. Fawckner has been advanced to the Senior List, with seniority of July 1st; J. W. Figgins has been advanced to the Senior List, with seniority of July 1st; G. H. Fryer, to the *Black Prince*, additional, to assist Engineer-Captain as oil fuel instructor, to date July 14th; H. S. Garwood has been advanced to the Senior List, with seniority of July 1st; W. H. Glasspole, to the *Cambridge*, additional, for the *Violet*, to date July 14th; F. Guyer, to the *Sapphire*, for the *Moy*, to date July 16th; P. C. W. Howe has been advanced to the Senior List, with seniority of July 1st; L. Howell has been advanced to the Senior List, with seniority of July 1st; J. H. Jenkin has been promoted to the rank of Engineer-Commander, and reappointed to the *President* as Engineer Overseer, Scotland District, to date July 5th; W. C. Johnson, to the *Powerful*, additional, for service on shore at Sydney, to date July 14th; F. E. Lamb has been advanced to the Senior List, with seniority of July 1st; J. Legate has been advanced to the Senior List, with seniority of July 1st; A. J. MacKean, to the *London*; T. J. Morgan has been advanced to the Senior List, with seniority of July 1st; A. E. J. Murray, to the *Wildfire*, for the *Endymion*; G. C. Nicolson, to the *Sapphire*, for the *Lively*, to date July 10th; W. H. Pratt, to the *Blake*, for the *Osprey*, to date July 10th; W. C. Sanders, to the *Astræa*, on recommissioning, undated; A. Saunders has been advanced to the Senior List, with seniority of July 1st; A. Saunders to the *Vivid*, for the *Cyclops*, and to assist on staff of Admiral Superintendent of District, to date July 12th; J. W. J. Sellex, to the *Victorious*; A. W. Sutton has been advanced to the Senior List, with seniority of July 1st; F. J. Sutton, to the *Victory*, for the *Cynthia*, to date July 10th; F. W. Sydenham, to the *Pembroke*, for the *Ghurka*, and to assist on staff of Admiral Superintendent of District, to date July 17th; A. M. Underhill has been advanced to the Senior List, with seniority of July 1st; L. Walker, to the *Astræa*, on recommissioning, undated; H. J. A. White, to the *Pegasus*, to date July 10th; F. C. Williams, to the *Prometheus*, on recommissioning, undated; W. S. Westbrook, to the *Tamar*, for the *Taku*, on recommissioning, undated.

Engineer Sub-Lieutenants.—L. Gregory, to the *Vengeance*, lent for training, to date July 20th; H. H. Huxham, to the *Berwick*, to date July 9th; F. B. Jaques, to the *Triumph*, lent for training, to date July 20th; J. S. Machan, to the *Illustrious*, lent for training, to date July 20th; W. Martin, to the *Russell*, lent for training, to date July 20th.

Engineer-Cadets.—The under-mentioned have been appointed Engineer Sub-Lieutenants in His Majesty's fleet: G. Cocks, L. Gregory, R. C. Grigg, H. M. Hayward, E. Iliff, F. B. Jaques, J. S. Machan, M. Martin, F. L. Mogg, W. F. Paffett, J. G. Parry, J. Pattinson, H. J. Rampling, H. W. Smith, L. H. Smith.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

THE Annual Glasgow Fair Holiday period, which marks the chief, but by no means the only "breathing time" of the hardy sons of toil in the shipyards and engine shops of the upper reaches of the Clyde, as well as of Glasgow and the iron and steel works in its vicinity, began on Thursday, July 12th, extra activity, as usual, having been evinced in putting a natural period to as much of the work on hand as possible before the stoppage, as well, probably, as endeavouring to put as much money in pocket as possible before that event. Cessation, of course, was very thorough, as employers themselves take advantage of the stoppage, not so much to take holiday as to effect improvements, and sometimes much-needed overhaul, of their plant. The shipyards and engine-shops ceased operations on Thursday at midday, and the steel works closed down on Friday. Operations, as usual, were not resumed in most of the works until Monday, the 23rd ult., while, in the case of some of the shipyards, the usual reluctance to make a "concerted" start accounted for several days' extension of the allotted time.

As regards the steel works, the past six months have formed a period of exceptional activity, all the works being employed to practically their full capacity. The financial results must be very satisfactory, although it would be misleading to assume that the realised prices for the products have in any way approached the Associated rates, which have been in operation during this year. In the autumn of last year very large quantities of material were contracted for at the prices then ruling *viz.*, on the basis of £5 17s. 6d. per ton, less 5 per cent., for ship plates and makers were engaged during the first three or four months of this year implementing those engagements. The outlook for the second half of this year is not altogether satisfactory. As our notes for months past have shown, comparatively few steamers have been placed on the Clyde, and, so long as iron and steel remain at the present levels, there is little inducement for shipowners in general trade to add to their fleets. With in the past fortnight, however, several highly important contracts have been booked for vessels for special purposes, as afterwards noticed.

During June, as recorded in these notes in July 6th issue, the output on the Clyde of 124,544 tons was far above that of any similar period in the history of the industry. The half-year's work of 336,258 tons was also 100,000 tons above that not only of the corresponding six months of 1905, but that of the previous highest half-year of 1902. Lloyd's Register officials now supply, in their quarterly return, a few more figures confirmatory of these results, and bearing upon the question of the amount of work still on hand. Compared with a year ago, there is an increased amount of work being done on the Clyde of about 60,000 tons, the total tonnage under construction being 527,930 tons, this again being a record figure. How much of the Clyde tonnage now in hand is being built for British, and how much for foreign, owners is a point on which Lloyd's returns throw no light. On the other hand, they show that, all over the United Kingdom, upwards of 240,000 tons are under construction to the order of other nations.

Orders for new mail and passenger steamships, for which, as has been noted repeatedly in this column, tenders have been under consideration by the Allan Line and by the Union Steamship Company of New Zealand, have now been placed. Messrs. William Denny & Brothers, Dumbarton, are to build for the latter company a large passenger and cargo steamer, to be fitted by them with turbine engines, as in the case of the two latest steamers built for the same proprietary and now performing such very satisfactory service at the Antipodes. For the same enterprising company, Messrs. Caird & Co., Greenock, are to build a steamer of similar size and character, but to be fitted with reciprocating engines.

Messrs. Alexander Stephen & Sons, Linthouse, have received the order for the new passenger and cargo steamer which Messrs. James & Alexander Allan invited tenders for some time ago. The new vessel will be single screw, about 470 ft. in length, and of about 10,000 tons gross. She is

intended for the Glasgow-Canadian trade of the Allan Line, and will be ready for next season's service. Like so many of the steamers built by Messrs. Stephen, and all the recent vessels of the Allan Line, she will be built to the highest class in the British Corporation Registry. She will be the third vessel of the present Allan Line fleet to come from the Linthouse yard. Messrs. Stephen, it will be remembered, launched the *Tunisian* for the Allan fleet, in 1900, and the turbine steamer *Victorian*, in 1904, the new vessel being about 30 ft. shorter than the *Tunisian*.

At Clydebank, work is being rapidly pushed forward on the record Cunarder *Lusitania*, which was launched under such brilliant auspices by Lady Inverclyde some weeks ago. It is anticipated that the huge turbine vessel will be ready for the first of her speed trials in seven or eight months from now. In this connection, it is of interest to state that the responsible post of chief engineer of the leviathan has been deputed to Mr. Alexander Duncan, who is presently in the *Campania*. Mr. Duncan learned his trade with Messrs. William Simons & Co., Renfrew, and has had a successful career in the Cunard service.

Messrs. Scott & Sons, Bowling, have recently put through most satisfactory trials the *Fritz Busse*, the first of the two vessels which have been built to the order of Busse, Geestemunde. Triple-expansion engines of large power, with boiler working at 180-lb. pressure, supplied by Messrs. Aitchison, Blair & Co., Clydebank, worked with the greatest smoothness throughout an extended trial, a speed of 10½ knots being easily maintained on the measured mile.

The Ailsa Shipbuilding Company, Troon and Ayr, with the launching of the third twin-screw steamer for Brazilian owners, have still on the stocks steamers for Messrs. Hugh Craig & Co., Messrs. Kelly, and Messrs. Ferris, all of Belfast. The firm have also on hand a steamer for William Sloan & Co., Glasgow, for their trade between Bristol Channel and South of England ports and the Clyde, and a steamer for the Zillah Shipping Company, of Warrington, for whom they have already built six vessels. For Mr. Cleto Japi Assu, of Bahia, Brazil, they are to build a light draught stern-wheeler, and two passenger and four cargo barges. These will be distributed between the Troon and Ayr yards. The firm have already built six framed wooden barges, 35 ft. long, for the San Domingo Railway Company, to be used in the river as lighters, and have another on order. In their recently erected engine works at Troon Harbour, the company have at present under construction two sets of engines for vessels which are being built at their yards. This marks the commencement of an engineering department which is a highly necessary, and promises to be a very successful, concomitant to the shipbuilding business of the company.

One of the latest and, though small, by no means the least interesting of the Ailsa Company's productions is the auxiliary motor boat *Red Riding Hood*, built for the Marquis of Ailsa, one of the principals of the company. After taking in stores at Culzean, the little craft sailed on the 10th inst., with her owner on board, for a trip to Cowes (Isle of Wight). Rigged as a two-masted lugger, and fitted with a three-cylinder paraffin motor engine of 17½ H.P., which drives the little vessel at a speed of 7 knots, she can develop a speed of 10 knots, with canvas set and engines running.

Irvine Harbour Trust, following permission from the Board of Trade, have agreed to an extension which Nobel's Explosives Company propose to make to their existing wharf in the River Garnock, together with certain necessary dredger operations. The extension to the wharf will be made in a northerly direction, and will measure 120 ft.

Messrs. Scott & Co., of Kinghorn, on the Fifeshire coast, have received an order from Messrs. P. D. Dodd & Co., London, to build a light-draught twin-screw steamer of about 230 ft. in length. The vessel is for clients abroad, and will cost somewhat under £16,000.

Mr. James Hamilton, a well-known Clyde naval architect, who has of late devoted considerable attention to the problem of housing propellers at the stern of steamers, where, for reasons of reduced speed and coal consumption, the whole of the propulsive agents are not required, is at present directing efforts towards solving the problem of fitting ordinary fishing-boats with auxiliary power in such a way as will enable them, at the minimum of cost, to compete with steam drifters and trawlers. He is having a fishing-boat of between 50 ft. and 60 ft. long, at present lying in the harbour of Anstruther, on the Fifeshire coast, fitted with a turbine engine and twin propellers, which possess features giving fair promise of the necessary conditions being fulfilled. When sail-power only is relied on—a condition which will obtain unless when the speed falls below 6 knots—the propellers are housed in an arrangement of after-chocks, or fins, so formed and fitted to the after "run" of the hull as to present the minimum of eddy-making and frictional surface to the passage of the water, and at the same time snugly house the propeller blades. Mr. Hamilton estimates that the power available between the sail and the steam will be equal to about 100 H.P. for the greater part of the year. For driving the two propellers, a steam turbine is adopted, this being of the De Laval type, made in England. It is, of course, fast running, but is geared down in speed of rotation, and the shafts are still further reduced in rotative speed by the use of chain-drivers of the English horse-chain make, associated with different sized sprocket-wheels, which permit the choice of the most efficient number of revolutions for the propellers, and the right pitch for the work. The condenser is of the Ljungstone type, and the boiler is fired by "Lucigen" oil, costing 1¾d. per gallon—sprayed through a special burner, which has already proved satisfactory on steam omnibuses and launches. The pumps are chain-belt-driven, and start and stop with the turbine, while the steam valve is only operative when the propellers are out in the working position. The propellers are of Bull's metal, which lends itself to straightening should they become bent in any way. Extending aft from the line of hull, along the "run" of the vessel on each side, is a wing chock, fixed square off the line of frame, which has a triangular spread as it goes aft, until, at the extremity, it provides a suitable receptacle for housing the propeller blades. This housing is accomplished by simply racking inwards the thrust-block and shaft about 8 in., thus bringing the propeller blades within the receptacle at aft end of chocks. The effect of twin propellers both rotating in the same direction to turn the boat's head is compensated for by placing one shaft further out transversely than the other. If Mr. Hamilton's expectations are realised and he has been experimenting in this line with a yacht on the Clyde for three years past—the adaptation of the existing fishing-boats in the way above outlined will be of immense benefit to fishermen generally.

Dundee shipbuilders, as our notes from week to week of late have shown, have been, on the whole, very well off for work, and, in the case of individual firms, such as the Caledon Company, a number of very notable productions have come into being. During June and July, four new orders were secured by Dundee builders, while, within that period, the new proprietary of the Dundee Shipbuilders' Company have made a fresh beginning with four vessels on hand. As noticed in our issue for July 6th, two of the recent contracts have been made by the Caledon Shipbuilding and Engineering Company, these being for 2,500-ton, high-speed, passenger and cargo steamers, for the Continental trade of Messrs. Wilsons and the North-Eastern Railway Company, Hull. Following upon this, it is satisfactory to note the booking, by another of the firms, of a contract for one of the biggest and most important steamers which have been secured by Dundee firms during recent years.

Messrs. Gourlay Brothers & Co., Ltd., have secured the contract for a high-class mail and passenger steamer for Messrs. Huddart, Parker & Co., a proprietary firm having their headquarters in Melbourne, Australia. This order is the third obtained from the same firm, the other two being the *Zealandia*, built in 1899, and the *Victoria*, launched in 1902, but the new steamer is to be considerably larger than either of these. She will be 400 ft. in length, and 52 ft. beam; and will be propelled by twin-screws, driven by two sets of triple-expansion engines, capable of giving the vessel a speed of fully 16 knots. There will be a large amount of work connected with her construction, and especially with her internal fittings and equipment, as she is to be a vessel of the most up-to-date order for mail and passenger service.

Messrs. Gourlay Brothers have recently completed two vessels and handed them over to their owners, after satisfactory speed trials. One of these is the *Princess Ena*, for the London and South-Western Railway Company's service, and the other the *Londres*, for passenger traffic on the River Plate. The latter is a three-decked, triple-screw steamer of almost unique design, the aim in which, both as regards hull and means of propulsion, has been to provide a steamer fitted with reciprocating engines and triple-screws capable of rivalling the turbine as applied to shallow water navigation. Her machinery has all been specially designed by Mr. J. Gordon Lion, of the Gourlay firm, and the results are such as to reflect the greatest credit on him and on the staff carrying out his ideas. On exhaustive trials, the *Londres* has

prove an unqualified success in fact, exceeding her speed requirements on a coal consumption of 20 per cent. less than was stipulated for. So well satisfied are the owners with the material and workmanship of the vessel, and especially with the low coal consumption, that they have sent Messrs. Gourlay & Co. a handsome cheque in the way of premium. The *Londres* left Dundee for her destined place of service on Friday, July 20th.

The search for the treasure supposed to have gone down in the Spanish ship which sank in Tobermory Bay, at the time of the Armada, is to be once more resumed. Mr. James Gush, the well-known diver, who was last year actively engaged in the hunt, left Greenock on the 11th inst., in his lighter *Beamer*, which will again be the vessel from which the diving operations will be conducted. As was the case last year, Captain Burns, Glasgow, is at the head of the syndicate which is prosecuting the search. At Tobermory, also, preparations are being made for the immediate erection of a wireless telegraph station, which is to be brought in connection with the corresponding station at Lochboisdale. The Tobermory station is to be constructed by the Marconi Company. On the 10th inst., Mr. Gray, London, a representative of the Marconi Company, visited Tobermory to make final arrangements. He took several photographs of the gardens in which the dynamo-house, apparatus store, and stays are to be situated, so that the material needed in the construction may be adapted to the site, which is close to the foot of a lofty cliff. Mr. Gray was accompanied by Mr. Noble, St. Martin's-le-Grand, London; Mr. Stewart, G.P.O., Glasgow; and Mr. Cunningham, district electrical engineer. The total height of the huge pole which is to carry the telegraph apparatus is 299 ft. above sea level, and each of the stays is to be kept in position by a block of concrete weighing two tons.

THE TYNE.

(*From our Own Correspondent.*)

Shipbuilding. The rumour is again revived that the Brazilian Government has placed with Messrs. Armstrong, Whitworth & Co. on order for three battleships of the largest class, together with the requisite armament. It is said that the designing department is at the moment very busy, which circumstance seems to imply that there is some basis of truth in the rumour mentioned, and a further ground for belief in the statement is to be found in the fact that deliveries of material have shown a marked increase of late. From the indications mentioned, it is evident that the company have got an accession of work, and that the prospect for the coming winter has brightened considerably. The fact of having additional work is the real question of importance; and, should the rumour only turn out to be correct, no one will greatly care whether the order came from South America or Japan. These are the only countries from which warship orders are ever again likely to come to England; and, in the matter of shipbuilding, at all events, it is to be feared that the latter country is already independent of us. The announcement that a Japanese shipping company of note, which hitherto got nearly all its vessels built in England, has just ordered six steamers of the largest class from establishments in Japan, is very significant, and points directly to the conclusion that very few more orders for ships of any kind will find their way from the premier country of the Far East to British yards. It was hardly to be expected that we could always continue to be the exclusive shipbuilders for the world; and it is now but too plainly evident that more and more of the world's trade in this branch of industry is going from us year by year. Though we cannot prevent other countries from trying their best as competitors, we must endeavour to hold the preponderance in shipbuilding, and this, we feel sure, will always be secured to us through our natural advantages, combined with the spirit of competitive enterprise which happily still survives.

We note that the contract for making a new graving dock of very large capacity has been given to a Manchester contractor by the Commercial Dry Dock Company, of Jarrow. The dock, it is hardly necessary to say, will be equipped in a manner commensurate with the importance of the undertaking. The dock, when completed, will bring the number of graving docks on the Tyne up to twenty five or twenty-six, several of which are capable of accommodating vessels up to 400 ft. in length, and at least three of which can take vessels up to considerably over 500 ft. in length. Messrs. Stephenson's graving dock, which was opened a couple of years ago, is large enough to receive vessels 700 ft. long, and it is at the moment occupied by the oil-carrying steamer *Narragansett*, which is said to be the largest petroleum steamer afloat, and is now to undergo an extensive overhaul. Messrs. Stephenson's shipbuilding department continues to be very busy, there being half-a-dozen vessels on the stocks, two of which are well advanced. The adjoining establishment of Messrs. Hawthorne, Leslie & Co. also presents an appearance of well-maintained activity: and in respect of Messrs. Wood, Skinner & Co.'s yard, Bill Quay, an equally favourable report can be given.

Messrs. Armstrong, Whitworth & Co. have just launched from their Low Walker yard an oil steamer, which, though not of large size, is of especial interest on account of the novelty of design, and the circumstance that the machinery will be driven by liquid fuel. We hear that the vacated berth will shortly be occupied with the keel for another vessel, and that the company have some further work in reserve. Messrs. Swan, Hunter & Wigham Richardson, Limited, have two or three vessels approaching completion, and it is understood that when these are launched they will be immediately succeeded by the keels for others. The Palmer's Company have a fair show of work on the stocks; and at the yard of the Northumberland Shipbuilding Company exceptional briskness is maintained. Messrs. Readhead also keep busy, and the Smith's Dock Company's shipbuilding department is quite full of work. Two berths just rendered vacant by the launching of vessels are again being prepared for the reception of keels. In the repairing branch the company are equally well off for work, there being no less than six vessels undergoing extensive repairs at their hands; whilst a sunken vessel is being "raised," to be subsequently overhauled and renovated in one of the company's docks. Messrs. Eltringham, of South Shields, have a couple of vessels in progress in their shipyard, and are fitting some vessels with new boilers at their boiler works. This firm, we note, have received the contract to supply the steel gates for the new graving dock about to be made at Jarrow.

Engineering.—At the Wallsend Slipway Works, and also at the North Eastern Marine Engine Works, business is extremely active, and the Neptune Works, Low Walker, as well as the St. Peter's Works, higher up, are running the machinery night and day, with a view to keep the output up to requirements. Messrs. Parson's works, Wallsend, are kept very busily going; and at Walker Gate, the establishments of Messrs. Donkin and Messrs. H. Watson & Sons, are both extremely busy in their respective branches of work. Messrs. Clarke, Chapman & Co., Gateshead, have all their departments well employed, the weekly output of ships' windlasses, winches, &c., continuing to be very large. The Northern Machine Tool Works, Felling (Messrs. Noble & Lund's), are as busy as they have been at any time since the initiation of their business, which is saying a good deal, seeing that the firm have enjoyed a practically uninterrupted run of prosperity since their removal from the Forth Banks, Newcastle, to their present premises. At Messrs. Abbot's works, most of the departments are well employed, the iron foundry particularly so. There is a good demand for the products of the rolling mills, and that department is also showing exceptional activity. Importations from Germany of castings and forgings for ships and engines are still causing pretty general slackness in the local forges, and this state of matters is more likely to be aggravated than otherwise in the near future, as requirements in this direction are daily becoming less.

THE WEAR.

(*From our Own Correspondent.*)

Shipbuilding.—It has not transpired that any new orders have been placed with Wear shipbuilders lately, and it is pretty well understood that enquiries for new tonnage are "few and far between." Only one or two firms, however, appear to be engaged on their last orders, and, so far as the majority of yards are concerned, there seems to be no doubt that they will be kept sufficiently busy up to the end of the year. In a few cases, it is known that the work in hand will last well into next year, and there are at least three yards in reference to which no apprehensions of slackness need be entertained for a very long time to come.

Messrs. J. L. Thompson & Sons will shortly put another vessel into the water, and the remaining four berths are occupied with vessels in different stages of framing and plating. Messrs. Blumer also have a vessel about ready for putting off the stocks, and it is understood that another keel will be put down as soon as the berth becomes vacant. At the yard of Messrs. John Crown & Sons there are two vessels building, and one is on the slipway getting repaired. The Sunderland Shipbuilding Company and Messrs. Bartram are still busy, the former firm having recently launched a finely designed vessel for Messrs. Cockerline, of Hull.

In the shipbuilding department at Messrs. Austin's, work is being pushed on with commendable energy, and we have little doubt that in the matter of tonnage output the firm will this year achieve something beyond anything done in former years. The ss. *Lucent*, which has suffered damage through having been ashore, has been in the graving dock some days, having part of her shell plating renewed, and other repairs carried out. For a considerable time past the firm's pontoon dock has been occupied almost every day without a break, the vessels docked requiring repairs or painting, and some of them being of very large dimensions. There is no doubt that the advantages peculiar to this dock (so far as the Wear is concerned) are being better appreciated as they become better known.

Messrs. Doxford, who launched a vessel on the 7th inst., have another about ready for leaving the stocks, and this will doubtless be put off within the month, thus fulfilling what is said to be the firm's ambition, namely, to put into the water two boats a month. There are, of course, two yards, each having its own separate equipment of machinery, to help in the realisation of so remarkable an achievement; but, making every allowance for the exceptional resources brought to bear, it is doubtful if such a rate of output could be regularly maintained. Messrs. Short Brothers have a vessel in an advanced stage of building, and three others in early stages; whilst at Messrs. Priestman's yard three berths are occupied. Messrs. Osborne & Graham are still busy, having all the berths engaged; and at Messrs. Pickersgill's there is a good deal of work in hand.

Engineering. The state of business at the Palmer's Hill Engine Works (Messrs. John Dickinson & Sons) continues satisfactory, night work being still maintained in the different departments. There are several locally owned vessels lying at the quay, or in its vicinity, and it is understood that, as regards one or two of them, the machinery is to receive attention. The other marine engine works continue to show sustained briskness, and foundries are also well employed. Messrs. John Lynn & Co., makers of steam winches, steering engines, &c., are exceedingly busy, and in the principal departments overtime is being worked nightly. Forges are generally less busy; but in the local ironworks full time is maintained, and the output is larger than at the corresponding period of last year.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

IT is a very trite saying that "Nothing succeeds like success," but the truth of it is seen every day. It is also true that they who achieve success soon find assistants ready to share in their success. Since it became apparent that the Ship Canal had "come to stay," the railway companies, one after another, began to *see how useful they could be* to the Ship Canal Company. The first railway company to make a permanent connection with the Canal was the London and North Western, followed by the Lancashire and Yorkshire Railway Company, which further established a goods warehouse of its own in Trafford Park. Now the Cheshire Lines Committee, which really represents the joint interests of the Midland, Great Central, and Great Northern Companies, is about to erect a warehouse in the same park. Meanwhile, the new curve at Throstle Nest, which is to afford a permanent connection between the Cheshire Lines and the dock railways, is making steady progress, and is expected to be completed early in the autumn.

The Bill to confirm a provisional order made by the Local Government Board relating to the Port of Manchester, in the matter of food inspection, has been confirmed by a Select Committee of the House of Commons.

During the month the members of the Junior Institution absence of the Lord Mayor, by Sir T. T. Shann, at the absence of the Lord Mayor, by Sir T. T. Shann, at the Town Hall. They paid visits to the Ship Canal, the Westinghouse Works, the School of Technology, and a local calico printing works.

Arrangements for direct steamship services to Manchester from the various cotton ports of America are now being made for next season, which begins about the middle of August.

The shipments of salt from Cheshire for June were 8,000 tons in excess of those recorded in the corresponding month of 1905. The shipments from Liverpool, Runcorn, and the Ship Canal exceeded 74,000 tons. For the half year the total shipments show an increase of more than 25,000 tons over the first six months of 1905.

Immense cargoes of grain are now on passage, or about to load, from various parts of the world, for Manchester docks. Nearly a dozen vessels could be mentioned, which are carrying a combined total of about 140,000 quarters.

The timber season is now in full swing. Cargoes are arriving almost every day. Older ports have been left a long way behind. A record is likely to be established. North America, Canada, and the Baltic ports are the chief exporters, but there is a good share from the Continent.

The shipments of cotton from Egypt to Manchester now total 207,997 bales which is 30,000 bales in excess of the previous record. Cotton from America is declining in quantity.

The comparatively new steamer, the *Viking*, belonging to the Isle of Man Steam Packet Company, recently ran from the Bailey Light to Douglas Head in 3 hours 10 minutes, which is about ten minutes the fastest time accomplished between these two points. She carried 1,000 passengers.

The approximate traffic returns of the Manchester Ship Canal for June amount to £45,956, against £41,453 for June last year, making a total of £229,571 for the first six months of the year, as compared with £205,041 for the first six months of 1905, showing an increase of £24,530. A visit to the docks is necessary for an outsider to realise the progress of the Canal. Coupled with the various engineering works in Trafford Park, the warehouses, stores, railway plant, and shipping, the locality presents a scene of great business animation.

During the first week in July, cotton goods, in one form or another, and yarn were exported from Manchester to the following countries:—Abyssinia, West Coast of Africa, Australia, New Zealand, Belgium, North America, Cyprus, Denmark, Bombay, Java, Egypt, Germany, Holland, Malta, River Plate, Sweden, Switzerland, Syria, Palestine, Tunis, Tripoli, and the United States of America. Egypt was the largest customer, with 1,660,639 yards of plain cloth, 556,060 yards of coloured cloth, and 49,150 lb. of yarn.

A new steamer, christened *Lurcher*, for trading between Manchester and Glasgow, was launched at Greenock on July 19th, from the yard of Messrs. Scott's, Limited. She is the first of two steam vessels which Messrs. G. & J. Burns are building for this trade. The *Lurcher*, whose design will be copied in the succeeding steamers, is of large cargo capacity, high speed, with every convenience for the rapid loading and discharge of freights. She will also carry steerage pasengers.

In the Chancery Division, during the July sittings, in the action of the Anglo-Austrian Bank and the Manchester Ship Canal for a writ of sequestration of the property of the Anglo-Austrian Trading Company, on the ground that there had been a contempt in discharging an order, Mr. Justice Bucknill made an order that the Anglo-Austrian Trading Company and the Eastern White Wood Company should, within four days after service, deliver on oath to the Receiver all contracts or other documents of title relating to the timber referred to in the order of April 6th or of May 11th, or to the sales thereof, and all invoices and specifications relating to the timber, and produce, for the the inspection of the Receiver or his agents, all books, accounts, or other documents under order, to be handed over to the Receiver relating to such sales. The defendants, the Anglo-Austrian Trading Company and the Eastern White Wood Company, were traders in timber, and the action arose out of advances made by the plaintiffs to enable the defendant companies to purchase consignments of timber. The Ship Canal Company, the third defendants,

were the wharfingers, in whose wharves the timber was stored.

The Lancashire coal trade continues firm in all classes of steam and forge coal, at good prices, but house coal is at zero. Speaking broadly, it is not wanted. In order to produce good slack, house coal is getting stacked for the winter. Coal for steamers on the Canal and for export is in steady demand, and for the better qualities higher terms are obtainable. Furnace coke in good request. Average quotations:—Best house coal, 13s. to 14s.; secondary, 12s. to 13s.; common, 9s. to 10s.; steam and forge, 8s. to 9s.; best engine fuel, 7s. 6d. to 8s. 6d.; best slack, 6s. 9d. to 7s. 6d.; common, 5s. to 6s.—at the pits. Coal for the shipping on the Canal, 9s. 6d. to 10s. 6d. per ton.

The iron trade of Lancashire has been depressed during the last few weeks. Prices of pig iron and hematite have fallen. Some classes of manufactured iron, especially bars, show weakness, and there is evidence of cutting to secure orders. Iron is plentiful, but users seem to have bought largely in the winter and spring for future delivery, and are not in need of extra metal at present. The textile and electric engineering works are certainly busy at the present time, and for ironwork generally the outlook is promising, especially for foreign and colonial requirements. Average quotations for Scotch brands of pig iron vary from 50s. to 63s. 6d. per ton., delivered at Manchester Docks, with the usual discount if landed at Heysham or Preston. Lincolnshire pig iron, No. 3, is 55s. 6d.; and ditto, No. 4, forge, 53s. delivered here; Derbyshire, No. 3, 55s.; Staffordshire, 54s. 6d.; Lancashire, 60s.; Hematites, West Coast, No. 3, 64s. 6d., f.o.t. at makers' works; ditto, No. 1, 65s. 6d.; East Coast, 65s., f.o.t. or f.o.b. Lancashire bars, £7 5s.; Yorkshire, ditto, £7 5s. Other descriptions of manufactured iron show no change from our last published list.

THE THAMES.

(*From our Own Correspondent.*)

WHEN the new Australian mail contract, by which two of our shipping companies are put on one side, in favour of a colonial combination, is considered, the more the matter looks as if a dead set were being made against our home firms by the colonies concerned, as, if, in fact, there is a desire to oust British shipping entirely. The syndicate, it appears, can be bought out by the Federal Government at any time—after the expiration of the agreement, of course—with the necessary payment for goodwill. A greater subsidy is to be paid than the Orient Co. had, but the service is to be shortened. The new fleet will be of nine steamers, of 11,000 tons each, and possessing great cargo-carrying capacity. Coming down to closer detail, it appears the new compact is for a period of ten years. The journey will be shortened by sixty hours, the speed of the vessels being fifteen knots. They will fly the Commonwealth flag, and employ white labour only. The annual subsidy is to be £125,000; and Brindisi will in future be the European mail port, instead of Naples, at which the Orient boats now call. This change assists the saving in time to be made.

The return of Lloyd's register of shipbuilding for the quarter ending June 30th has just been issued, and on that date there were in the United Kingdom, exclusive of warships, 569 vessels under construction, with a total tonnage of 1,409,456. As this compares with 472 vessels of 1,301,457 tons on the same date last year, the report may be considered favourable. The present total is within 4,000 of the figures reached in September, 1901, which is the highest on record. Of the present figures, 447 vessels —with a tonnage of 1,197,861—are for British or Colonial account.

The Austin Friars SS. Co. has issued its annual report, which shows that the company possesses eleven steamers, and has made a profit on voyages for the year of £15,341, and, after paying expenses, &c., there is a credit balance of £7,922. This fleet aggregates 52,530 tons, with an average age of nine years.

A very important figure in the shipping world, in the person of Sir Henry Hozier, the secretary of Lloyd's, has retired. This gentleman has had a very varied career, having in early life been in the Royal Artillery, and served in the Chinese War. Next we hear of him as correspondent of "The Times," during the campaign between Austria and Prussia, in 1866. Afterwards he was appointed secretary of a commission for forming a reserve for the Army, but took active duties again during the Abyssinian Expedition, under Lord Napier of Magdala, and, at its conclusion, after a period again on the War Office staff, received the appointment of secretary of Lloyd's, in 1874. He is also a writer of some repute, on military matters mostly. A successor for this post has been found in the person of Capt. Inglefield, R.N.

The citizens of London have presented a handsome silver shield, to be competed for by the gun's crews annually, a silk ensign and a bell, weighing half a ton, and modelled from the famous Bow bells, with a silver bracket and some plate for the officers' mess, as mementoes of the connection of the ship to the city whose name she bears.

Recently, the Royal Naval Club entertained the First Lord of the Admiralty to dinner, and included among the guests was Sir Philip Watts, the Director of Construction at headquarters. On this occasion, Admiral of the Fleet Sir E. H. Seymour presided.

Other yacht races on the Thames have been those of the Royal Thames Yacht Club, from the Nore to Dover; and the Royal Corinthian Yacht Club, from Port Victoria, round the Mouse Light, the East River, the Middle Buoy, and the Nore Lightship. In the former races, there were as many as twenty yachts started, and, finishing in the dark, some little difficulty was found in the timing owing to this cause. The smaller boats went inside the Goodwins, and the larger outside. The racing on the Thames has been most successful this season in every way.

Messrs. Yarrow & Co. have launched the torpedo-boat destroyer *Storm* for the Greek Government. The dimensions of the vessel are 220 ft. long, by 20 ft. 6 in. beam, and for armament there are to be two 12-pounders, four 6-pounders, and two torpedo tubes for 18-in. torpedoes. A second similar vessel is in hand for the same government.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—The position of the shipbuilding industry in this district is less satisfactory. Vickers, Sons & Maxim have fewer orders in hand than at any time since they took over the Naval Construction Works at Barrow. They have been cultivating the business of warship construction, and have paid very little heed to ordinary merchant work. Their yard is, indeed, laid out more for Admiralty than for merchant work. They have been in negotiation for orders of considerable importance for some time, but up to the present they have resulted in nothing, and, of course, the order for Brazilian warships, part of which was expected at Barrow, went past Vickers to the Armstrong, Whitworth firm. There is, of course, the chance of orders from the Chilian Government, who are in need of warships, and there is also a chance of orders from the Argentine Republic; but there is almost the certainty of big orders from Russia, though doubtless the unsettled state of that country is less responsible for the delay than the fact that Russia has not made up her mind what sort of ships she will require. The probability is that several "Dreadnoughts" will be ordered, and the chances are that some of these vessels will be built at Barrow, but nothing definite has yet been determined on. There is also the prospect that the order for one of the "Dreadnoughts" required from private builders by the British Admiralty will find its way to Barrow. Further than this, the order for several British submarines—eleven or twelve—is expected from the British Admiralty during the course of the year, and in the meantime there is much activity in this department at Vickers's yard, not only because the Admiralty are anxious to get delivery as soon as possible of the submarines already on order, but that work may be begun on the new "D" class of submarines, which are of a much larger type, and will represent a great deal more work, as well as entail a much greater

expense. In the meantime, however, the work in hand at the Vickers' yard only represents the Russian first-class cruiser *Rurik*, the second small cruiser for the Peruvian Government, and a small ice-breaker for Canada, outside, of course, the submarines. Vickers could do with six times more work to be going on with; but it is evident for some time they will be very slack, as any new orders booked would take some time to get them under weigh, and the three vessels named are to be launched by October this year.

The only department of Vickers's works at Barrow which is short of orders, however, is that of shipbuilding. In all other branches there is the greatest activity, and it is these branches which pay the best, as there is less competition in them than in shipbuilding; but, of course, the firm wants shipbuilding orders as well, and especially orders for warships, in order to find work for the armour, ordnance, and engineering branches of their works. There is full activity in the gun-mounting department, and projectiles, gun carriages, electric assessories, and other departments, are all very busy. The firm has just decided to make another very large addition to their gun-mounting department, as, although they have already a very big shop—one of the largest in the world—fitted up with the most modern tools, they have not room to deal with many of the orders which are in hand, and also in prospective.

The work of constructing the second Peruvian cruiser is so well forward that it is expected she will be launched in September. Her sister ship, the *Almirante Grau*, is now almost ready for her trials. She looks a fast type of ship, with her two ponderous funnels and the rake of her masts. She is, indeed, intended for high speed, like the British scouts.

It is believed, in the next shipbuilding programme, the Admiralty will include a marked addition to the six scouts already built, as the recent naval manœuvres have demonstrated the excellence of these vessels as the "eyes of the fleet."

The trials of H.M.S. *Natal*, first-class armoured and protected cruiser, are to take place at the end of July on the Clyde, and it is expected the vessel will give a good account of herself.

West Cumberland. The shipbuilding industry in West Cumberland is very steadily employed, and new orders are occasionally booked, so that a steady and regular run of work proceeds. Only comparatively small craft is built; but both at the Workington and Maryport yards there are indications of healthy trade.

Shipbuilding Material.—There are not many orders in hand for plates or other classes of shipbuilding material in this district, and the mills are consequently on short time. Indeed, it is evident that during the winter, unless the demand improves, there will be a very quiet time at the plate mills, and forgings, castings, &c., are also in quiet request.

The Hematite Trade.—There is a very small trade doing in hematite iron. Prices are down at 63s. 11½d., net cash sellers, makers quoting 65s. to 66s. net f.o.b. Stocks are lower at 72,789 tons. The output of iron has been reduced by the blowing out of two furnaces.

Shipping. The exports of iron and steel this year have reached 443,370 tons, being a decrease of 21,353 tons on the corresponding period of last year. Freights are easy.

BELFAST.

(*From our Own Correspondent.*)

THE "Twelfth" holidays have now come to an end, and work is once more in full swing in shipbuilding yards and engine works. There is a considerable amount in hand at present; this, however, cannot last for ever, and it is to be hoped that some of the important inquiries that have come Belfast way recently will result in business.

Orders in progress at the Queen's Island include steamers for the White Star, Leyland, Elder Dempster, and Hamburg-American lines, and for the Anglo-American Oil Company. Correspondence has passed recently between Messrs. Harland & Wolff and the Harbour Commissioners, with regard to the question of graving dock accommodation in Belfast. Messrs. Harland & Wolff justly emphasise the necessity for pushing forward with all despatch the repairs to the Alexandra Graving Dock, and the construction of the new graving dock, pointing out that the loss to the city within the last six or seven months, owing to a great amount of repair work having to go elsewhere, has been anything from £200,000 and £250,000. During this period, fifteen large steamers and a sailing ship, all controlled by the Queen's Island firm, have had to be dry-docked either in Liverpool, Southampton, the Clyde, Rotterdam, Antwerp, or other ports. One of these repair jobs, Messrs. Harland & Wolff state, cost upwards of £70,000; and another, which had to be completed in Hamburg, was over £40,000. In addition to this, the firm calls attention to the fact that it has been compelled to refuse a considerable amount of work from London, Liverpool, and other owners. In their second letter to the Commissioners, Messrs. Harland & Wolff intimate that they have received from an expert a report to the effect that, at the present rate of progress, the new dock will not be available for ten years. In this communication, they go on to say: "Apart altogether from the very serious loss to the Commissioners' revenue, and the great loss to the working classes and trade of the town, not to speak of our own loss, the injury to the shipbuilding industry of the port by reason of the delay is very great, because, through the want of docking facilities, work that would be coming here is going elsewhere, and we think the Commissioners will quite understand that it not infrequently happens that once business gets a turn in a certain direction, it is very hard to get it back again." In view of the serious position of affairs, for serious it undoubtedly is, not only for the local shipbuilders but for the port itself, Messrs. Harland & Wolff have asked the harbour authorities, if they find it impossible to have the dock ready for use within a reasonable time, to let the former have ground upon which they could themselves construct a dock, which, they believe, could be completed in two years. With reference to the question of hurrying on the work at the docks, the Commissioners simply instructed the secretary to inform Messrs. Harland & Wolff that every possible exertion was being used to expedite the works alluded to. As regards Messrs. Harland & Wolff's proposal to build a dock themselves, the Commissioners reply that if the former will make a definite proposal, it will receive their due consideration. Thus the matter stands for the present. Meanwhile, additional work will have to be turned away from the port for want of dry-docking accommodation.

Messrs. Workman, Clark & Co. have a good deal of work in progress, with prospects of future orders. The most important vessel being built by them is the twin-screw mail and passenger steamer *Araguaya*, for the Royal Mail Steam Packet Company. This liner is at present at the fitting-out berth. The Holt liner *Pyrrhus*, which was repaired and overhauled by this firm, and has since been lying in the Musgrave Channel, has sailed from the port.

The Ayr Steamship Company, which carries on a passenger and cargo trade between Belfast and Ayr, has purchased from the Glasgow, Dublin, and Londonderry Steam Packet Company, their steamer *Cedar*. She has been renamed *Dunure*, and is taking the place of the Ayr Company's *Carrick*, which was, a few weeks since, sunk in collision with the *Duke of Gordon*, near Ailsa Craig.

In the last issue, mention was made of Messrs. Burns' new steamers, *Woodcock* and *Partridge*, which have been built for the night service between Belfast and Ardrossan. In speaking of the passenger accommodation being aft, it should have been said that there are a few state-rooms amidships, round the engine-room casing.

The news of Mr. Wolff's retiral from active participation in the affairs of Messrs. Harland & Wolff is not altogether a matter of surprise. As a matter of fact, Mr. Wolff has for some years past been gradually "easing off," leaving almost the entire business of the concern practically in the hands of Lord Pirrie. The latter, by the way, took his seat in the House of Lords for the first time on July 23rd, his sponsors being Lord Tweedmouth and Lord Kelvin.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Steel Barge.—On July 19th the Blyth Shipbuilding Company, Limited, launched from their shipbuilding and graving dock works, a steel barge, measuring 100 ft. by 28 ft., by 8 ft. depth (moulded), which has been built to the order of Messrs. Lobnitz & Co., Limited, of Renfrew, for use in the River Blyth. This barge will be specially fitted with powerful machinery by Messrs. Lobnitz for rock-cutting, which will obviate the use of explosives. The hull has been built under the supervision of Messrs. J. Watt, Sandeman & Son, of Newcastle, the engineers to the Blyth Harbour Commissioners.

Antigone.—On July 23rd Messrs. Craig, Taylor & Co., Limited, launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled steel screw steamer, of the following dimensions, viz.:—316 ft. by 44 ft. by 22 ft. 6 in. (moulded). She is built of steel to the highest class in Lloyd's, under special survey, and is of the single-deck type, with poop, long bridge, and topgallant forecastle, water ballast in double bottom fore and aft, and in peak. She is fitted with patent steam windlass, with quick-warping ends, by Messrs. Emerson, Walker & Thompson Brothers, patent steam-steering gear, five large steam winches, by Messrs. Robert Roger & Co., Limited, Sudron's donkey boiler, Hastie's screw-gear aft, telescopic masts to Manchester Ship Canal's requirements, and all the latest improvements. The accommodation for captain and officers is neatly fitted up in large central deckhouse, with handsome saloon, and the engineers are berthed in houses at the after end of the bridge, and the crew in the forecastle. Her engines have been constructed by Messrs. The North Eastern Marine Engineering Company, Limited, Sunderland, the cylinders being 22 in., 36 in., 59 in., by 39 in., with two large steel boilers, working at 160 lb. pressure of steam. The vessel, which is similar to a number the firm has already built, is for the Egypt and Levant Steamship Company, of London (Messrs. Alfred Laming & Co., London). The ship and engines have been built under the superintendence of Mr. W. H. Robson. As the vessel left the ways, she was gracefully christened the *Antigone* by Mrs. W. H. Robson, wife of the superintendent.

Corte.—On July 23rd the steamer *Corte*, building for the mail and passenger service of Messrs. Fraissinet & Co., Marseilles, between Marseilles, Nice, and Corsica, was launched from the Neptune Works of Swan, Hunter & Wigham Richardson, Limited. The vessel is a sister ship to the *Gelo* and *Liamone*, recently completed at the same works for the same service. She is 273 ft. in length, by 34½ ft. beam, and is being constructed under special survey of the Bureau Veritas and the owners' inspectors. There will be handsome and luxurious accommodation for over 50 first-class passengers, including dining saloon, state-rooms, smoke-room, &c. Forty-six second-class passengers will be provided for in a dining saloon, state rooms, &c., also 40 third-class passengers in berths, as well as a shelter for a large number of deck passengers. The propelling machinery will consist of a set of four-crank triple-expansion engines on the Yarrow, Schlick, and Tweedy system, which, together with the boilers, are being constructed at the Neptune Works, and which are expected to drive the vessel at a speed of over 18 knots per hour. The christening ceremony was gracefully performed by Miss Dorothy Tweedy, of Kelso House, Newcastle-on-Tyne.

Ethyl.—On July 23rd Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer off three-deck rule, with poop, long bridge, and topgallant 47 ft. 6 in.; depth, 24 ft. 9 in. The vessel will be classed 100 A1 at Lloyd's, and is built on the single-deck type of three-deck rule, with poop, long bridge, and topgallant forecastle, and will have clear holds. The accommodation for captain and officers is fitted up in the poop, engineers in steel houses on bridge deck. The crew will be berthed in the forecastle as usual. The vessel has double-bottom for water ballast on the cellular principle, and will also carry water ballast in the after peak. She will be fully equipped with an up-to-date outfit, embracing quick-warping steam windlass, stockless anchors, steam-steering gear amidships, and powerful screw-gear aft. The appliances for loading and discharging expeditiously are very complete, and include six 7 in. by 10 in. double cylinder steam winches, steam being supplied by a large horizontal multitubular donkey boiler, by Messrs. Thomas Sudron & Co., Limited, Stockton-on-Tees. The engines will be of the triple-expansion type, by Messrs. Blair & Co., Limited, of Stockton-on-Tees, of about 1,200 I.H.P. The engine outfit is very complete, and includes spare tail-end shaft, evaporator, &c. Wailes, Dove & Co.'s bitumastic enamels were applied to the double-bottom, peaks, and bunkers, and bitumastic covering to tank tops. The vessel has been built to the order of Messrs. W. Tulley & Co., Hull, under the superintendence of Mr. J. L. Richardson, M.I.N.A., also of Hull. The christening ceremony was gracefully performed by Mrs. Ada Sanderson, of Hull, who gave the vessel the name of *Ethyl*.

Kolpino.—On July 23rd there was launched from the yard of Earle's Shipbuilding and Engineering Company, Limited, Hull, a fine steel screw steamer, which has been built to the order of Messrs. Thomas Wilson, Sons & Co., Limited, for the passenger and cargo trade between Hull and St. Petersburg. This is a sister ship to the *Mourino*, which was launched from the same yard a few weeks ago, and had a very successful trial lately. The vessel is 300 ft. in length, 40 ft. beam, 20 ft. 11 in. in depth, and has been built to British Corporation highest class, and specially strengthened to withstand the severe wear and tear due to the large quantities of ice encountered in the upper Baltic at the opening and closing of the navigation. Triple-expansion engines are to be provided by the builders, steam being supplied by two large steel boilers, designed to drive the vessel at a good speed on a minimum coal consumption. As the vessel left the ways she was christened the *Kolpino* by Mrs. Robinson, of Ferriby House.

Mathilda.—On July 23rd Messrs. William Gray & Co., Limited, launched, at West Hartlepool, the large steel screw steamer *Mathilda*, which they have built to the order of Jacob Christensen, Esq., Bergen. The vessel will take the highest class in Lloyd's, and is of the following dimensions, viz.:—Length overall, 371 ft. 6 in.; breadth, 50 ft.; and depth, 27 ft. 6 in., with long bridge, poop, and topgallant forecastle. The saloon, state-rooms, captain's, officers', and engineers' accommodation will be in large houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep frames, cellular double-bottom, and aft peak ballast tank, eight steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, grain divisions, stockless anchors, telescopic masts with fore-and-aft rig, boats on beams overhead, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 42 in., and 70 in. diameter, with a piston stroke of 45 in., and two large steel boilers, for a working pressure of 180 lb. per square inch. Wailes, Dove & Co.'s bitumastic enamels were applied to the bunkers, and boiler-room tank, and bitumastic covering to the tank top in boiler-room. The ship and machinery have been constructed under the superintendence of Mr. C. Macdonald, M.I.N.A., Newcastle, on behalf of the owners, and the ceremony of naming the steamer *Mathilda* was gracefully performed by Mrs. Soren Olsen, of West Hartlepool.

Alexandra.—On July 24th Messrs. William Gray & Co., Limited, launched, at West Hartlepool, the handsome steel screw steamer *Alexandra* which they have built for Messrs. C. Nielsen & Sons, West Hartlepool. She will take the highest class in Lloyd's, and is of the following dimensions, viz:—Length overall, 342 ft.; breadth, 46 ft.; and depth, 24 ft. 4 in.; with long bridge, poop, and topgallant forecastle. The saloon, state-rooms, captain's, officers', and engineers' rooms, &c., will be fitted up in houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep frames, cellular double-bottom, and large after-peak tank for water ballast, six steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, patent vertical multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore-and-aft rig, boats on beams overhead, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in., and 64 in. diameter, with a piston-stroke of 42 in., and two large steel boilers, to work at a pressure of 160 lb. per square inch. The ship and machinery have been constructed under the superintendence of Mr. P. Bahnsen, on behalf of the owners, and the ceremony of naming the steamer *Alexandra* was gracefully performed

by Mrs. Hans C. Nielsen, of Hartlepool, wife of the managing owner.

Ariadne.—On July 24th there was launched, from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 117 ft. 2 in. by 22 ft. by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Messrs. The Consolidated Steam Fishing and Ice Company (Grimsby), Limited, of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways, she was gracefully christened the *Ariadne* by Mrs. T. R. Ronald, of Welling, Kent, wife of the chairman of the company, after which the company adjourned to the Londesbrough Arms Hotel, where luncheon was served, and the customary toasts were given and responded to. Amongst those present were Mr. and Mrs. Ronald, Mr. and Miss Marsden, Sir George Doughty, M.P., and Mr. J. Schofield, who is surveying these vessels.

Asgard.—On July 24th an important launch took place from the yard of the Northumberland Shipbuilding Company, Limited, Howdon-on-Tyne. The vessel launched is a fine moulded steamer, built to the order of Messrs. The Midgard Deutsche Seeverkahrs Aktiengesellschaft, of Bremen it being the second vessel for this company built by the Northumberland Shipbuilding Company, who have other four vessels on the stocks for the same owners. The vessel is 372 ft overall by 48 ft. beam (extreme), by 30 ft. 10 in. depth moulded). She is designed to carry about 7,300 tons deadweight, on a draught of 25 ft. 3 in. The vessel is to take the highest class at Lloyd's spar deck rule, with extra strengthening for special freeboard. The deck erections consist of poop, bridge, and topgallant forecastle. The accommodation, which is very commodious, is placed in steel houses on the bridge deck for captain, officers, and engineers, whilst the crew have spacious rooms under the topgallant forecastle. The 'tween decks are so arranged that cattle, troops, or emigrants may be carried if necessary. The deck machinery consists of eight powerful steam winches, by Messrs. Clarke, Chapman & Co., Limited, Gateshead-on-Tyne. Steam windlass, by Messrs. Emerson, Walker, and Thompson Brothers, and the steam-steering gear by Messrs. Hastie & Co., Greenock. Special arrangements have been made in connection with the loading and discharging gear, so as to ensure rapid loading and discharging cargoes. The vessel has water ballast in cellular double bottom and after peak. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Limited, Sunderland, the engines having cylinders 25 in., 41 in., and 69 in., by 48 in. stroke. Three large steel boilers, 14 ft. by 10 ft. 9 in., working at a pressure of 180 lb. per square inch, will be fitted. The christening ceremony was gracefully performed by Miss Hodge, of Bescombe, Bournemouth, the vessel being named the *Asgard* as she commenced to move down the ways.

Sunda.—On July 24th Messrs. J. Scarr & Son launched from their Beverley yard a steel barge, being the third of an order for six built for Messrs. Joseph Rank, Limited, of London. The vessel, which was named *Sunda*, has a carrying capacity of 170 tons, and is of the following dimensions:—Length, 70 ft.; beam, 20 ft.; depth, 8 ft.

LAUNCHES—Scotch.

Lurcher. On July 19th there was launched at Greenock by Scotts' Shipbuilding and Engineering Company, Limited, a steamer for the service between Glasgow and Manchester which is conducted by Messrs. G. & J. Burns, Limited. The vessel is the first of two steamers which Messrs. Burns are building for this trade, and she is specially adapted for all the requirements of the service, being of large cargo capacity and high speed, and having every modern convenience for quickly loading and discharging cargo. The vessel has been built to Board of Trade requirements, and is to have Lloyd's highest class of classification. She will also carry steerage passengers, and commodious accommodation has been provided for them. The dimensions are:—Length, 233 ft.; breadth, 33 ft.; depth, 16½ ft. The builders will supply triple-expansion engines. The vessel was named the *Lurcher* by the Hon. Emily Burns, the eldest daughter of Lord and Lady Inverclyde, who were also present.

Marien.—On July 21st there was launched, at Aberdeen, by Messrs. John Duthie, Sons & Co., Limited, the single-screw steamer *Marien*, which they have built to the order of the North Eastern Shipping Company, Limited, Aberdeen, to Lloyd's highest class. The vessel, which is 155 ft. in length, 24 ft. in breadth, and 12 ft. 6 in. in depth, will have triple-expansion engines by Mr. W. V. V. Lidgerwood, Coatbridge.

Aysen. On July 24th the *Aysen*, of about 4,300 tons, was launched by Messrs. John Reid & Co., Limited, Whiteinch, for the Campania Sud Americana de Vapores, Valparaiso. This vessel measures about 400 ft. long by 44 ft. beam, and has passenger accommodation throughout, as usual in this company's vessels for their service on the West Coast of South America, and is a sister ship to the *Huasco*, recently completed by Messrs. Reid & Co. for the same owners. She will be fitted with powerful machinery by Messrs. Dunsmuir & Jackson, of Govan, and has been built under the superintendence of Mr. Thomas Dewsbury, of Leeds, the company's representative in this country, and will be commanded by Captain Selmer. On leaving the ways, the steamer was named by Miss Dewsbury, Leeds.

TRIAL TRIPS.

Trinity.—On July 11th the handsome steel screw steamer *Trinity*, of which we gave particulars in our June issue, page 461, was taken to sea for her trial trip. She has been built by Messrs. Wm. Gray & Co., Ltd., West Hartlepool, and engined at the Central Marine Engine Works of the builders, for Mr. David Cairns, of Leith. The vessel carried a full cargo of coals, and was bound for Barcelona, on completion of the trial. After adjustment of compasses by Mr. Berry, she headed to the south, and the engines were opened out for a full-speed trial, when an average of 10 knots was recorded, everything in both ship and engine departments giving entire satisfaction. The owner, Mr. David Cairns, was present, together with his superintending engineer, Mr. Thos. Harrold; Captain Lister was in command, and the ship and engine builders were represented by Captain J. N. Murrell and Mr. Wm. Reynard respectively.

Aagot. On July 17th the steel screw steamer *Aagot* (of which we gave particulars in our June 15th issue, page 509), left the port of Hartlepool for her trial trip. She has been built by Messrs. Wm. Gray & Co., Ltd., and engined at the Central Marine Engine Works of the builders, for Messrs. S. M. Kuhnle & Son, of Bergen. The vessel was in ballast trim, and, after adjustment of compasses, full-speed trials were made to test her capabilities. The mean speed recorded was 11 knots, the performance of ship and machinery being in every respect satisfactory. The vessel afterwards proceeded on her voyage to Philadelphia (U.S.A.).

Daffodil. On July 18th the new ferry steamer *Daffodil* was taken out to the measured mile in the Mersey, on her official trial trip. This is a sister vessel to the *Iris*, only recently completed, and now running in the service of the Wallasey Urban District Council with great success. The *Daffodil*, with her sister vessel, has been constructed by Messrs. R. Stephenson & Co., of Hebburn-on-Tyne, and engined by Messrs. David Rollo & Sons, of Liverpool, and the whole of the work has been carried out under the supervision of Messrs. Flannery & Given, of Liverpool, London, and Rotterdam, in conjunction with Captain Howard E. Martin, manager of the Wallasey Ferries. The principal dimensions of the *Daffodil* are: Length, 159 ft. 5 in.; beam, 40 ft. 6 in.; and moulded depth, 11 ft. 6 in.; and it is expected the vessel will accommodate about 1,800 passengers. The main deck accommodation consists of two general saloons, one ladies' saloon, and one smoking-saloon, and special consideration has been given to the heating and ventilating arrangements, and the vessel is fitted out with a complete electric installation. During the trial trip the vessel behaved in a very satisfactory manner, and the engines worked smoothly throughout, and, when taking her runs on the measured mile, she exceeded her contract speed of 12½ knots.

Fritzoe.—On July 20th the ss. *Fritzoe* (of which we gave particulars in our June 29th issue, page 557), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesbrough-on-Tees, and engined by the North Eastern Marine Engineering Co., Ltd., of Sunderland, proceeded to

sea for her official trials. She is a very special cargo steamer, built to Norwegian Veritas highest class, with cantilever frames on Harroway & Dixon, John Priestman, and Livingston & Sanderson's Patents, to the order of Messrs. Fearnley & Eger, of Christiania, under charter of the Dominion Coal Co., of Sydney, Nova Scotia. Her trial trip passed off most successfully, and the vessel proceeded direct, in ballast, to Sydney, Nova Scotia, under the command of Captain Einar Qvale.

Ada.—On July 21st, the official trial trip of the ss. *Ada* (of which we gave particulars in our June 15th issue, page 509), took place in Hartlepool Bay, after adjusting compasses. The vessel has been built for Messrs The Seaton Shipping Co., Ltd. (Messrs. J. S. Allison & Co., managers), by Messrs. Furness, Withy & Co., Ltd., Hartlepool; and engined by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool. The engines ran very smoothly throughout the trial, a speed of 12 knots being maintained. Mr. Sidney Hogg, with Mr. C. P. Sanderson (superintendent), represented the owners. The vessel afterwards proceeded to Tyne Dock to load.

Antiope.—On July 21st the handsome steel screw steamer *Antiope* had her trial trip in Hartlepool Bay. She has been built by Messrs Wm. Gray & Co., Ltd., West Hartlepool, her owners being Messrs. A. Laming & Co., of London. She takes Lloyd's highest class, and her principal dimensions are: Length over all, 342 ft.; breadth, 46 ft.; and depth, 24 ft. 4 in. She has long bridge, poop, and topgallant forecastle. The saloon, state-rooms, captain's, officers', engineers' rooms, &c., are fitted up in houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom, and aft peak for water ballast. Triple-expansion engines have been supplied from the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and two large steel boilers adapted for a working pressure of 160 lb. per square inch. The trial was carried out under light ship conditions, the average speed being 11 knots, everything in both ship and engine departments giving entire satisfaction. The vessel was bound for Antwerp, for which port a course was set immediately upon the conclusion of the trial.

Snowdon Range.—On July 21st the finely modelled steel screw steamer *Snowdon Range* (of which we gave particulars in our June 29th issue, page 557), built by Irvine's Shipbuilding Dry Docks Co., Ltd., West Hartlepool, and engined by Messrs. Richardsons, Westgarth & Co., to the order of the Neptune Steam Navigation Co., Ltd., Newcastle-on-Tyne, proceeded to sea on her trial. After adjusting the compasses, the vessel was run at full speed, the engines working smoothly and well, the vessel displaying good sea qualities, a speed of 11 knots being attained. The vessel then proceeded to Blyth.

Fagersand.—Lately, the steamer *Fagersand*, built to the order of Mr. A. Monsen, Tonsberg, went out from the Tyne for her official trial trip. This vessel has been built to Det Norske Veritas highest class, for the West Indian trade, her dimensions being 210 ft. by 32 ft. by 19 ft. The machinery consists of a set of triple-expansion engines, having cylinders 17½ in., 28½ in., and 47 in. diameter, with a stroke of 30 in., and two steel boilers working at 180 lb. pressure. The trial proved in all respects a highly satisfactory one, a mean speed of 11¾ knots being easily maintained over the measured mile.

Fritz Busse.—Lately, the trial trip of the *Fritz Busse* (of which we gave particulars in our June 29th issue, page 558), the first of two vessels which have been ordered by Mr. Busse, Geestemunde, has been satisfactorily carried out. Triple-expansion engines of large power, with boiler working at 180 lb. pressure, have been supplied, and throughout an extended trial the machinery worked with the greatest smoothness, a speed of 10½ knots being easily maintained on the measured mile.

Jequitinhonha.—Lately, the twin-screw steamer *Jequitinhonha* (of which we gave particulars in our May 18th issue, page 414), recently ran her trials at Skelmorlie, attaining a speed of 13 knots. This is the first of three sister vessels which are building to the order of Mr. Cleto Japi-Assu, acting on behalf of the Government of Bahia (Brazil), through Mesrs. John M. Campbell & Son, Glasgow.

BOARD OF TRADE EXAMINATIONS.

Extra 1st Class.—July 21st, 1906.

Aitken, David H.	Ex 1C London.
Berry, Rupert J.	Ex 1C London.
Branson, Ernest M.	Ex 1C N. Shields.
Crewe, Vere	Ex 1C Liverpool.
Le Mesurier, Vincent G.	Ex 1C Liverpool.
Matthews, James	Ex 1C N. Shields.
Morris, Alexander...	Ex 1C Sunderland.
Smith, Percy	Ex 1C London.
Vipond, Charles	Ex 1C Liverpool.
Weir, Andrew C.	Ex 1C N. Shields.
Williamson, Alexander	Ex 1C London.

NOTE.—1C denotes First Class; 2C Second Class.

July 14th, 1906.

Barrett, E. B....	1C N. Shields
Blacklock, R. C.	1C N. Shields
Bremner, James	1C Liverpool
Campbell, D. G.	1C Greenock
Dunn, Robert ...	2C N. Shields
Evans, W. V. ...	2C London
Florence, J. C. .	1C London
Fraser, A.... ...	2C Greenock
Fraser, W. H. ...	2C Hull
Goffin, F. W. C.	2C Hull
Greenslade, S....	2C London
Hamilton, B. ...	2C N. Shields
Heck, John S. ...	1C N. Shields
Jeffrey, J. B. ...	1C Liverpool
Johnson, G. M. .	1C N. Shields
Jones, Eric S. ...	2C London
Laidlaw, E. D. .	1C Liverpool
M'Allister, Percy	1C London
Martin, Hugh ...	2C Liverpool
Matthews, T. F.	2C Liverpool
Morley, R. C. ...	2C N. Shields
Morton, W. J....	2C N. Shields
M'Vean, M. C....	2C Greenock
Poole, James E..	1C Liverpool
Price, Stanley...	2C Liverpool
Ridley, F. B. ...	1C London
Rimer, George...	2C N. Shields
Ross, James A....	1C Hull
Saville, D. B. S.	1C Dover
Stewart, John ...	1C Liverpool
Yule, Ronald ...	1C Hull

July 21st.

Aird, David S....	2C Glasgow
Aitkenhead, J. D.	2C Glasgow
Andrew, John ...	2C Glasgow
Barnes, William.	1C Glasgow
Beattie, James .	1C Glasgow
Cairns, John ...	1C Leith
Campbell, J. O. .	1C Glasgow
Campbell, P. J. J.	1C London
Carter, Stephen	2C N. Shields
Clark, William...	1C W. Hart'l
Clarke, Richard	2C London
Coad, John B. ...	2C London
Dickson, James S.	2C Glasgow
Dow, Donald M.	1C Liverpool
Duncan, Thomas	2C N. Shields
Edwards, E. H.	1C Liverpool
Fleming, R. S....	1C London
Gardner, W. A. .	2C W. Hart'l
Gillespie, J. W. .	1C Glasgow
Graham, R. H....	2C W. Hart'l
Grimwood, R. J.	2C Leith
Hall, H. G. F....	2C London
Hepple, Richard	1C N. Shields
Hildreth, William	1C W. Hart'l
Hindmarch, W. .	2C N. Shields
Howarth, Harold	1C W. Hart'l
Jacobs, G. J. ...	2C London
Lamb, Robert ...	2C N. Shields
Larter, W. H. ...	2C Cardiff
Maclean, A. B. .	2C London
Mauchline, J. ...	1C Glasgow
McDowell, R. ...	2C Barrow
M'Crindle, H. ...	1C Glasgow
M'Ilhatton, J. ...	2C Glasgow
M'Millan, M. ...	2C Leith
Neil, Joseph ...	1C W. Hart'l
Nicolson, W. B.	2C Glasgow
Parsons, W. H....	1C Leith
Piper, Richard .	2C N. Shields
Roper, Alfred G.	1C South'ton
Russell, J. A. ...	1C Liverpool
Scobie, William	1C Cardiff
Scott, Robert C.	2C London
Stephenson, R. .	2C W. Hart'l
Stevenson, R. ...	2C Liverpool
Stockwell, John	2C W. Hart'l
Sutton-Jones, H.	1C Liverpool
Sutherland, H. A.	2C Glasgow
Tighe, John ...	1C W. Hart'l
Tilling, G. G. ..	2C Liverpool
Trask, Arthur E.	1C South'ton
Tripp, Hubert C.	2C W. Hart'l
Watson, E. G. G.	2C Liverpool
Williams, J. R. .	1C Cardiff
Willoughby, W.	1C London
Wilvers, J. E. J.	2C London
Youngson, A. W.	1C Leith

Thorn's School of Marine Engineering.—At the examination held on July 10th, 11th, and 12th, the following passed for extra first-class engineers:—Mr. E. M. Branson, West Hartlepool, and Mr. A. C. Weir, of Dundee, both succeeding the first time of going up. Mr. Branson was prepared by the system of postal tuition introduced by Mr. Thorn. At some recent examinations for extra first-class, out of 53 successful pupils from this school, 26 were prepared by this corresponding method, and out of these 24 passed the first time, making 139 successes altogether in this grade from the establishment of W. H. Thorn & Son, 5, Waterville-terrace, North Shields.

The Marine Engineer

And Naval Architect.

LONDON, SEPTEMBER 1, 1906.

SERIOUS as the case of H.M.S. *Montagu* has proved to be from the national and navigational points of view, it is satisfactory indeed to see that there was no question of any default or neglect on the part of any of the engine-room staff. It has been placed on record that all behaved with exemplary steadiness after the happening of the disaster, in spite of the fact that the ship was in darkness and fog, and seemed likely to slip off the cruel rocks or go to pieces. It should, further, not be forgotten that when Captain Adair was asked by the members of the court-martial whether there were any members of the crew whom he would wish to particularly commend, he desired to make no invidious distinctions where all had done so well, yet, at the same time, he could not refrain from mentioning the name of Artificer-Engineer Marchant.

The engine-room staff, indeed, seemed to have done everything that was possible to locate the damage and to isolate the compartments into which an inflow of water was taking place. But it must have been obvious to them, as it is to all those who read the evidence given at the court-martial, that from the moment that her engines "stopped of their own accord," the ship was doomed. Bulkheads were starting and the hull straining to such an extent that no forces at the command, even of the twentieth-century salvors, could ever hope to make her float again.

The cause of the loss of the ship was evidently the extreme reliance placed by the *Montagu's* navigators on dead reckoning, and the somewhat crude methods by which that dead reckoning was reached. The patent log was not in use, and the speed of the ship through the water was arrived at by a calculation that three revolutions meant half a knot's speed. This is a rule-of-thumb method which we might have expected to have seen used by those who drove the early steamboats, but which does not commend itself to those who are accustomed to the exact systems of modern science. For it must be apparent to everyone that, though at certain speeds this may be fairly accurate, it cannot be considered that it could be true at all possible speeds. For every engineer knows that slip is variable, that at low speeds it decreases and at high it is intensified. Again, we have the difficulties which the *Montagu's* mission placed upon those who had to direct her course. Her last departure was taken about seven and a quarter hours before her stranding. In that time she ran away down channel towards Scilly, stopping from time to time, and even slightly swinging, and then she was made to retrace her steps. All this time she was under the influence of the tidal streams—which in these waters are both strong and uncertain—and of such wind as there was. The difficulties of calculating all the factors that had to be considered are appreciable by any person who considers the matter, and it is clear that dead reckoning could not be relied on under the circumstances. The lead was, indeed, used as an aid to the navigation of the ship. But the Admiralty directions—which the captain had not, apparently, read—point out that in this vicinity the lead is not reliable. Moreover, the half-hourly soundings which were taken were not sufficient for the purpose of checking the ship's position. The fog-signals of the Lundy Station were being listened for, and it is said were not heard. But this is not to be wondered at. For everyone who has experience of the sea is aware that fog has a strange effect upon sound signals. Sometimes they are not heard at all, sometimes their bearing is entirely altered. These things may have been difficulties in the way of the safe navigation of the ship; but difficulties have generally been but an incentive to effort with the King's sailors. If it was imperative, as Captain Adair believed it to be, for him to keep on his way to Lundy in the dense fog in which he found himself, he should certainly have realised the conditions, and especially the fact that his dead reckoning was not to be trusted, and so neglected no precaution. If the ship had been kept dead slow, and the lead kept going continuously, this casualty need never have happened. Even as it was, at the eleventh hour, the lead gave a distinct warning of what was coming, when it announced that the ship was in 19 fathoms, thirty being expected. Had the ship been stopped at once she would have been saved. But both the captain and the navigating lieutenant were below, and precious time was lost, whilst they were told of the warning. The court-martial could not, on the evidence, have come to any other decision than it did. But we must remark on his behalf that the captain had other things to think of than the navigation of the ship—these wireless experiments, for example, necessarily largely occupied his mind. Now, both the Admiralty and the officers of the deck must not fail to remember that navigation is one of the first necessities at sea, and, if need be, the duties of our officers must be so divided that someone is responsible for navigation, and is able, when circumstances demand it, not only to find adequate assistance from his subordinates, but also to devote his whole mind to this vital duty.

We have before us the papers as read before the meeting of the Iron and Steel Institute, and of these we have to distinguish the most worthy of notice. We consider that the tempering and cutting tests of high-speed steels, by Professor H. C. H. Carpenter, is one well worth our notice, as so much attention is at present being made as to the points of these high-speed steels. This research is but a continuation of one submitted to the Iron and Steel Institute last year. The alloy

steels selected for the tempering tests were chosen from those used in the writer's research previously referred to, and are, therefore, all the more interesting. They are composed of carbon silicon steel, all with from 2·4 to 3·7 of chromium, but with some are alloyed 8 to 13 per cent. of tungsten, and others with 4 per cent. to nearly 9 per cent. of molybdenum. The method of hardening employed was as follows:—A selection of steel about $\frac{1}{8}$ in. thick was heated to 1,200 deg. C. in a porcelaine-tube furnace, and was air-quenched in a cold blast of air from a blower. It was then polished, and its structure was then examined under the photomicrophone. These alloys were then tempered by re-heating them to various degrees of temperature, and the photomicrographs were noted. The range of temperatures was from 400 deg. to 900 deg., if necessary. The condition of the tempering of the steels was plainly shown by the photomicrographs, when it was plainly seen that no tempering took place below 550 deg. C. It was shown that the tempering started from a series of centres, and gradually invaded the rest of the material. At 600 deg. C., the white polyhedra disappear, and the structure consists of a fairly uniformly coloured, ill-defined, granular mass, from which all evidence of polyhedra is absent. At 650 deg., small white crystals make their appearance, but they do not attain their proper proportion, corresponding to fully tempered material, until after treatment at 700 deg. C. It was to be noted, from these examples, that the higher the quenching temperature the longer the time needed for etching, and also the higher the quenching temperature, the larger the polyhedra. The structural types have been found to occur in both steels in the same order. The first stage is of the appearance of a brownish tint, at times mingled with white patches of unaltered material. The second stage is rendered evident by the appearance of spots, whose colour ranges from yellowish-blue to dark blue. In the third stage, white spots are found dotted about in a mass, which may be deep-blue or deep-brown, or a mixture of these. It is to be noted that, provided the alloy is quenched at a temperature at which, with ordinary rates of cooling, the splitting and lowering of the critical ranges is brought about, nothing is gained by exceeding this temperature.

MODERN METHODS OF PIPE-FLANGING BY MACHINERY.

By Luther D. Lovekin, M.I.N.A.,
Engineer-in-Chief to the New York Shipbuilding Co., Camden, New Jersey, U.S.A.

THE subject of attaching flanges to pipes for all purposes is one to which the writer has given considerable thought and attention during the past six years, and, having investigated the various methods in use, he begs to submit to the engineering world a new method, which has been well tried, and found to possess great advantages over former practices for all classes of pipe work wherein flanges are required to be used.

One of the chief advantages in connection with this work is its application in attaching flanges to copper pipe, principally because the practice in this field of work has remained almost constant during the past fifty years or more.

Thousands of pounds are unnecessarily expended annually owing to the crude methods employed in doing this work by hand.

The following is a brief description of the present methods employed in most copper shops throughout the country, together with a comparison of the work necessary when using the "Lovekin" machines and tools in order to produce work of the character shown in Figs. 5 and 6 of this article.

In order to connect the flange and pipe under the old methods, flanges are made and *turned on the face and bored*, after which the copper pipe is entered into the same, and penned or hammered by hand, so much as to distort the flange in almost every case. This, however, does not form a tight joint, and, in order to prevent leakage, brazing has to be resorted to, which, as is well known, materially decreases the strength of the pipe, inasmuch as excessive heating destroys the properties of the copper, and warps and twists the flanges.

After this is finished, another expense is added. The pipe is then taken to the machine shop and placed on a boring and facing machine, to be faced up, and the amount of time necessary to reface this flange complete depends entirely on the shape of the pipe and the size of the same, a 4-in. pipe requiring anywhere from one to two hours to complete said work. This amounts to a large sum per annum, and, when finished, it will not begin to compare with that done by the machine.

With the machine-made joint, the flange is bored and faced, placed in the machine, pipe entered, and clamped, and the operation completed in about ten minutes, for a 4-in. pipe, the expanding, flaring, and facing being perfect; and, inasmuch as we can see the effect of the tool-marks on the copper, we know the danger of leaking is no more than that of a boiler tube, where we resort to expanding alone.

I believe the old rules compelling the brazing of pipes were originated on account of the impossibility of securing tight joints with high pressure, leakage occurring between pipe and flange on the outside; but, with tests which we have conducted with our machine-made joints, before the U.S. Steamboat Inspectors and the Navy Department, brazing is not essential, and there is no comparison as to neatness, efficiency, and cost of production.

The "Lovekin" machines and tools were designed to meet the demands of shipbuilders and engineers generally, where a large amount of wrought iron, steel, and copper piping is required to be expanded tightly in the flange, as well as flared at the ends, thus dispensing with the common practice of screwing or penning by hammer, especially so when such pipes are subjected to the action of salt water or to any vibration.

Steam and exhaust piping, and also the bilge and ballast systems of vessels have given considerable

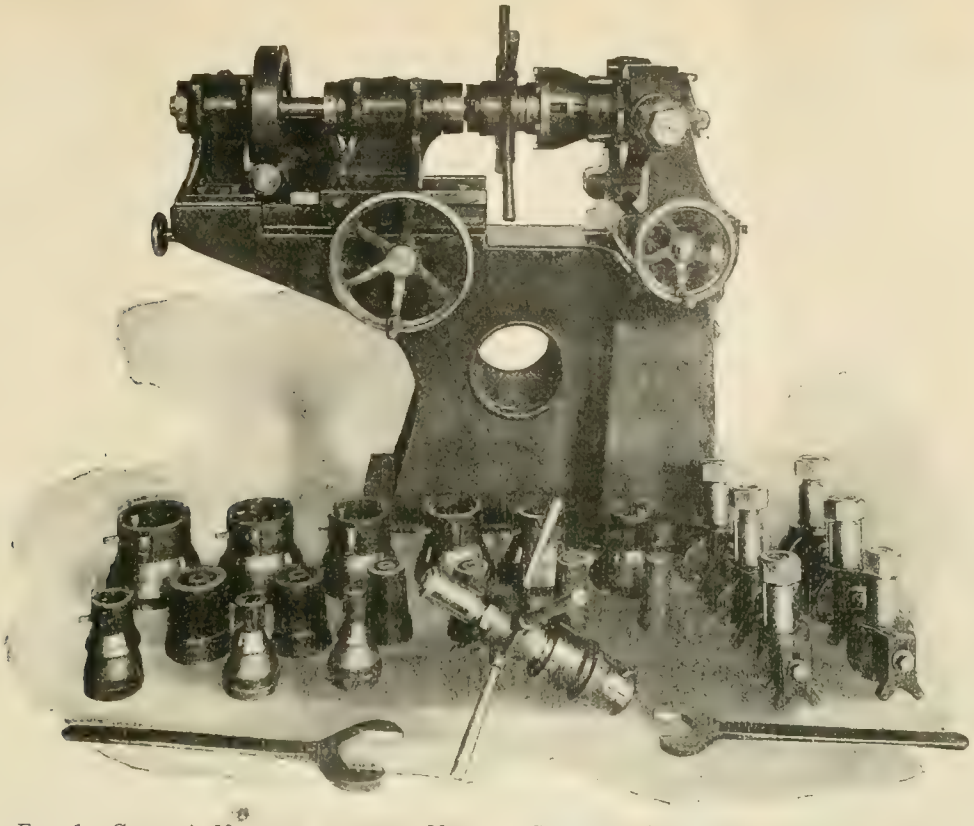


Fig. 1.—Class A Machine, without Motor. Shewing Full Set of Tools and Jaws.

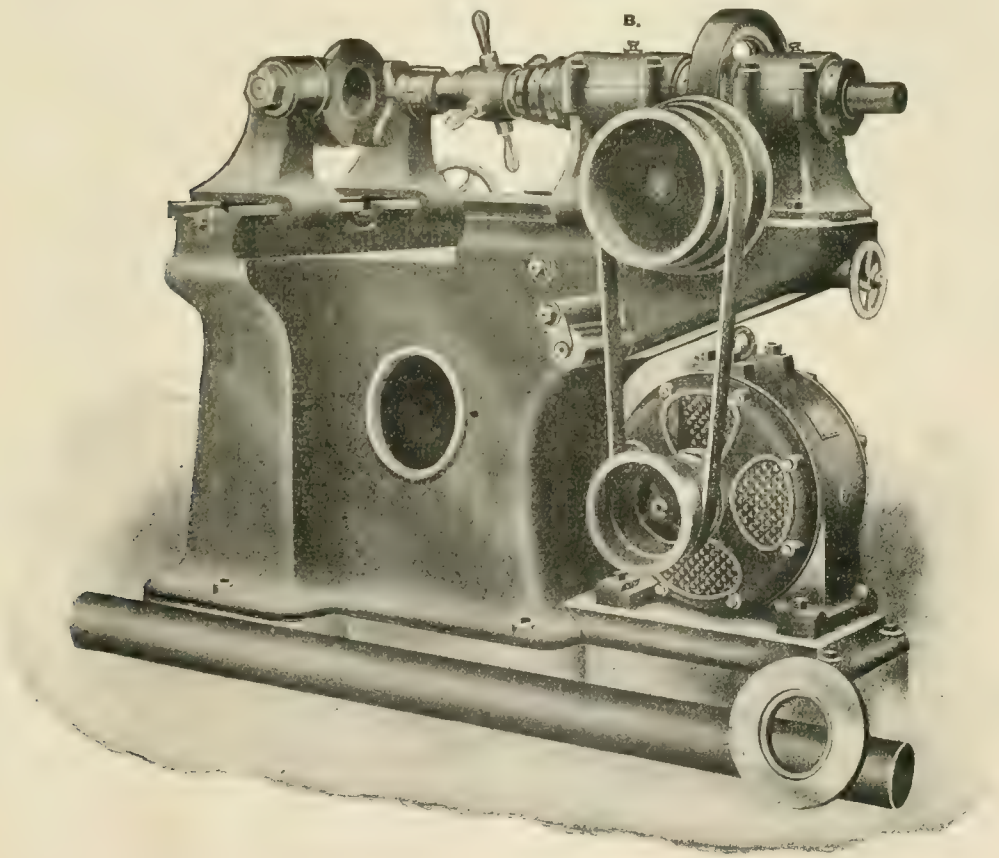


Fig. 2.—Class A, with Motor, will Flange Pipe from 2 in. to 7½ in. in Diameter, Inclusive.

trouble, due to using the threaded pipe, and, therefore, it is about time such practices were stopped.

I will now describe the new type of machines and tools which are being placed on the market to do this class of work in the most approved manner, with a saving that should startle the proprietors of all such establishments where these old methods prevail.

The description of Class "A" Lovekin Expanding and Flanging Machine for copper pipes, 2 in. to 7½ in. inclusive, and standard lap-welded steel pipe up to 6 in. diameter, is as follows:—

Referring to Figs. 1, 2, and 3, it will be seen that this machine consists of a cast-iron base, having, at the rear end, a motor for driving the same. The motor drives the machine by means of a belt to the cone pulleys, so as to permit of variable speeds being used.

Between this enlarged portion and the bracket "B," suitable anti-friction rings are provided, thus reducing the friction to a minimum. This shaft is secured, at the rear end of the movable bracket "B," by means of a round nut, as shown in Fig. 1. This enables the shaft to revolve freely in this movable bearing, but it cannot move forward, unless bracket "B," is advanced.

This bracket "B" is made with adjustable guides at the sides, and is also provided with a nut underneath, through which passes a lead screw. The lead screw is provided with bevel wheels of suitable size, and located to suit the best position of the operator in charge.

This lead screw is used to move the head "B" to and from the work to be operated upon, as desired. Thus, it will be seen that all the forward and back-

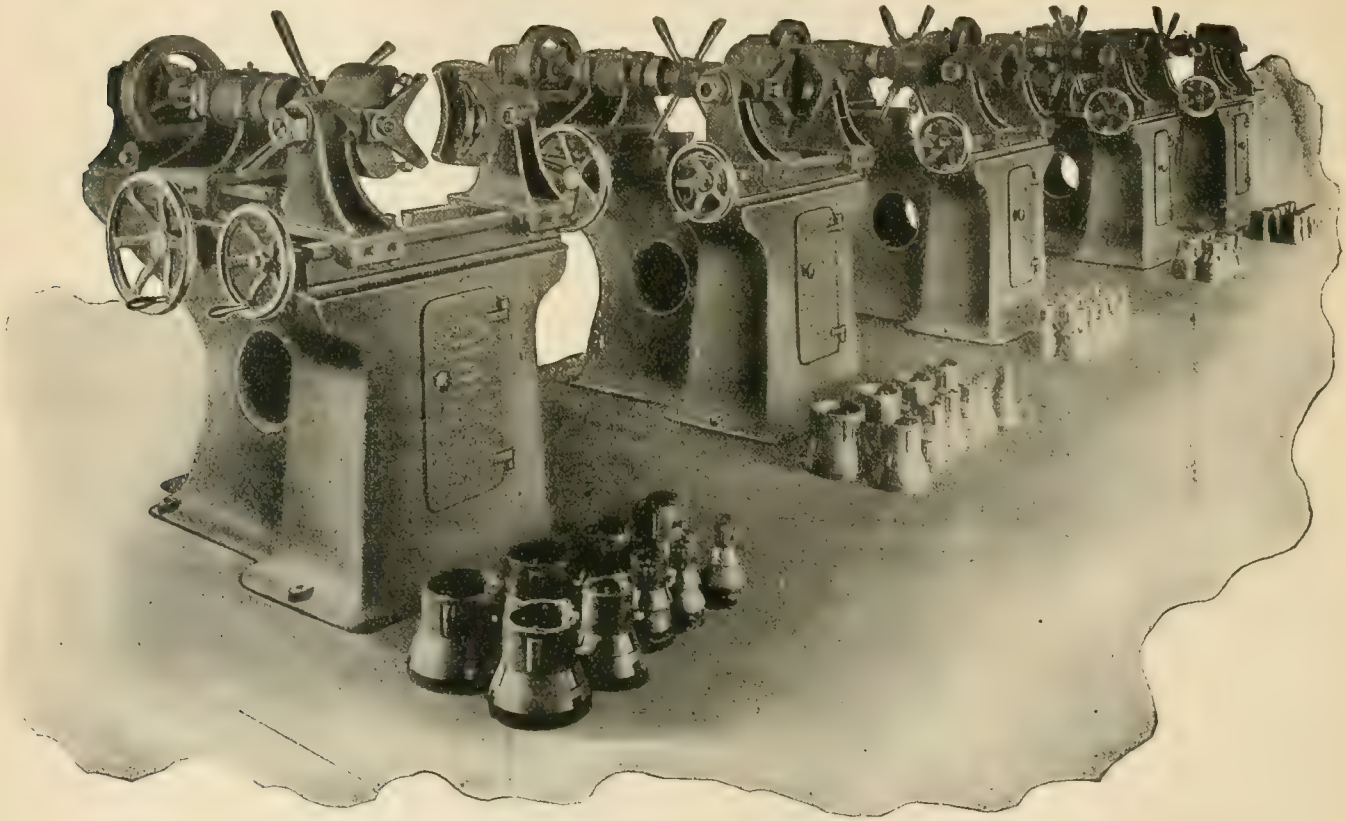


Fig. 3.—Five Class A Machines. Delivered to Various U.S. Navy Yards During the Year of 1905.

This cone-pulley shaft is provided with a worm, which engages in a worm wheel, suitably housed on the rear end of the machine. The worm wheel has a long sleeve cast on the same, and is also provided with a round collar, or nut, at the extreme end of this sleeve. This worm wheel and its sleeve are free to revolve; the inner bore of this sleeve is provided with a key-way, so as to allow the central, or driven, shaft to move freely forward and backward as desired, and the feather transmits the power to the central, or driven shaft, causing it to revolve.

This worm and worm wheel, together with their brackets, all form a fixed part of the machine, with relation to the driving mechanism. The central shaft passes through the worm wheel, and is enlarged at the front end to form a socket for all kinds of tools.

ward movement necessary for the various sizes of pipes is obtained by means of this sliding bracket "B." In addition, the central shaft revolves in this bracket, and, to provide for the end thrust on this bracket, the lower edges are provided with good and substantial guide strips, thus preventing any tendency to lift up, due to this end thrust.

The front portion of the machine consists of two sliding heads mounted on suitable guideways on the base of the machine. These heads have a right and left-hand screw, passing through nuts on the under side of the same, causing said heads to move from each other at equal distances from the centre. The heads are made of cast iron, and are fitted with detachable clamping jaws of cast iron. These jaws are also provided with steel "V" grips, for holding the

pipe centrally, and to prevent pipe from turning while being expanded.

The cast-iron jaws are made with grooves of suitable size, to permit the flange being held in the same independent of the pipe. These grooves are faced, so as to be in perfect alignment with the central shaft. This permits the flange being placed exactly in line, as desired; and at the back end suitable set screws are located, so as to force the faced portion of the flange against the faced portion of the jaws. The backs of the flange being rough castings, and at times having bosses on the back, make this essential.

The machine is also provided with suitable locker and shelves at the front end. These will be found useful for stowing small parts.

A description of tools used in connection with the Lovekin Expanding Machine (Class "A") will now be given.

The tools consist of a steel casting, shank and body in one piece, bored out to receive a forged steel mandrel, as shown in Figs. 4 and 4A.

The body is slotted out to suit the feeding screw, "F," in order to give the inner mandrel, "E," the proper movement necessary for expanding. The feeding screw, "F," engages into the feeding wheel, "G," and, as will be seen, any movement of wheel,

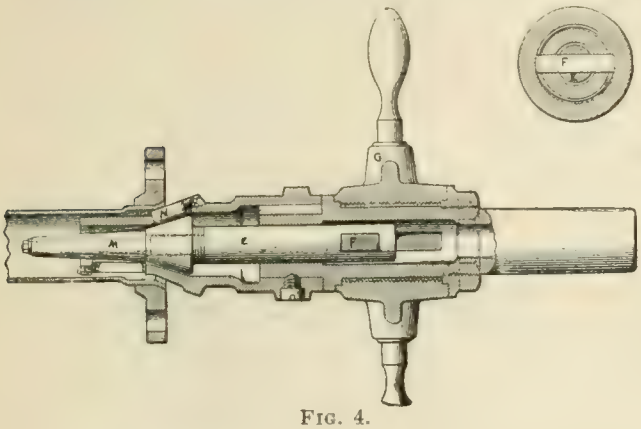


Fig. 4.

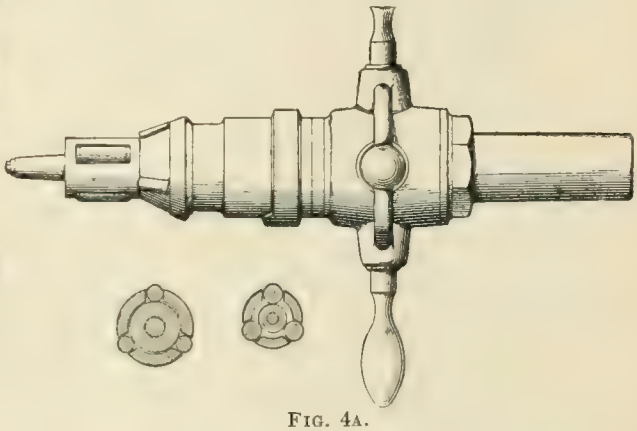


Fig. 4A.

"G," causes the feed screw, "F," to move outward or inward, as desired. Feeding wheel, "G," is held in place by a nut at the rear end; this nut also takes the thrust due to forcing the expanding and flaring rollers ahead, and is also provided with a facing at the rear end, which, when unscrewing from the mandrel proper, comes in contact with the socket head on machine, and thus makes a very useful device for withdrawing the tool shank. The shank is provided with suitable feather and set screw for holding the tool in place, and the end of shank comes in contact with the bottom of the bore in socket, thus giving a very firm backing for the tool proper, in case of excessive end thrust.

As will be seen, the shank is arranged at its front end to receive a series of detachable heads to suit the various sizes of pipes. These heads are made of steels castings, bored to suit the end of the shank on body of tool. They are also provided with suitable key-way and feather, in addition to the set screw, as shown. Each head has a series of slots, suitably finished to receive the expanding and flaring rollers, and the said rollers are held in place by means of set screws, as shown. All faces on the heads coming in contact with rollers are hardened, to insure lasting qualities.

The central rollers are mounted freely on the reduced portion of mandrel, "E," and are provided with suitable anti-friction washers at their rear end to absorb the thrust. These rollers are steel, hardened, and are held in place by suitable nut and washer, at the end of the mandrel, as shown.

The principle embodied in this expander is that of a central revolving roller, upon which operate the expanding rollers. The mandrel, having no work to perform further than forcing the central rollers outward and inward, as desired, is, therefore, not subjected to the extreme torsional stresses of other types, which constantly require new mandrels being made.

In operating the Lovekin Expanding Machine (Class "A"), first place the pipe and flange in jaws provided for same; then advance the tool so that the expanding rollers enter the pipe for about one inch; then force the expanding rollers outward by means of the hand-feeding wheel, so as to insure the pipe being central with the tool.

While the pipe is in this central position with the tool, clamp flange at the back by means of the set screw provided; then set the "V" grips in contact with the outside diameter of the pipe (being careful to see that these grips are in proper contact); then clamp the grips while in this position, and advance the set screws at the rear end of these "V" grips, so as to prevent any possibility of the grips slipping.

The pipe and flange are now held independently of each other.

We are now ready to begin expanding.

In order to expand, advance tool so that the end of the expanding rollers are at a distance of about $\frac{1}{4}$ in. more than the total depth of the flange at the bore. This is done to insure the expanding showing up clearly at the back of the flange. While the tool is in this position, start motor, which will revolve the tool. The tool, in revolving, however, does not work on the pipe until we grasp the handles which are in connection with the internal feeding screw, causing a retarding or braking action, thereby forcing the central mandrel, with its conical rollers, ahead, which causes the expanding rollers to move outward.

The amount of retarding necessary to completely expand the pipe depends on various conditions; and, therefore, must be governed entirely by the operator in charge.

After pipe is expanded, reverse the direction of the

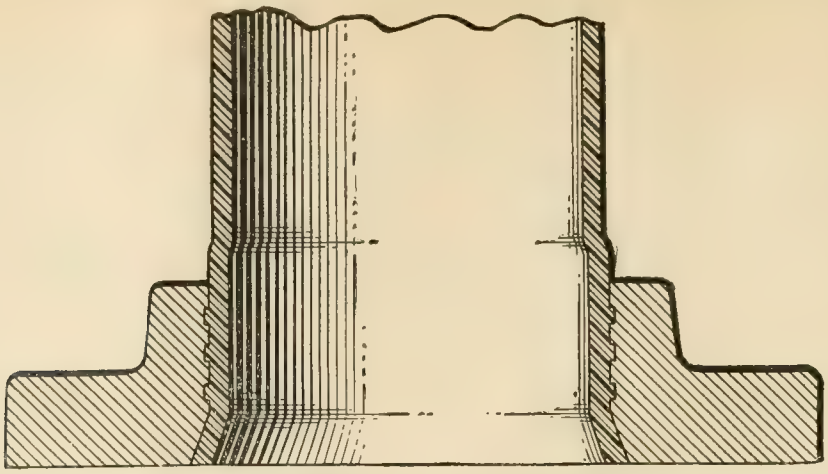


Fig. 5.—Section of Pipe and Flange. As Made by Lovekin Expanding and Flanging Machinery.

feeding wheel, which will cause the expanding rollers to collapse; withdraw the tool from the pipe, and remove the central roller, "M," or, preferably, the three small expanding rollers "N." Then advance the tool until the flaring rollers are sufficiently within the flange, and continue the retarding or braking action in a similar manner to that of expanding, until the pipe is completely flared. Withdraw tool again, and insert facing cutter; then advance the tool so as to trim off the ends of the pipe flush with the flange.

When accustomed to this work, the operation of placing the flange and pipe in the machine, expanding, flaring, and facing has been done, on many occasions, with $3\frac{1}{2}$ in. steel pipe, $\frac{1}{8}$ in. thick, in $7\frac{1}{2}$ min.

A table giving the amount of time taken to expand, flare, and face pipe, by the "Lovekin Machine," is shown below.

In conclusion, I would state that the methods described can be used to advantage on locomotive and marine boilers (no stay tubes required; every tube acts as a stay tube by our methods), evaporators, distillers, feed-water heaters (brass or steel tubes), brass pipe (for all purposes), copper pipe (for both high or low pressures, steam or water), all classes of iron and steel (high and low pressure) pipe, and ammonia work.

Special loose flange pipe joints are made by our process, thus giving us every advantage over other methods in high-pressure steam pipes for large power-houses, as well as the highest grade of marine work.

Every engineer knows the great advantage of a loose flange joint when erecting large piping, and European engineers are using these methods almost entirely.

These machines are made in three sizes, which are classed as follows:—

Class "A": for pipes, 2 in. to $7\frac{1}{2}$ in. in copper; 2 in. to 6 in. in steel.

Class "B": for pipes, $5\frac{1}{2}$ in. to 16 in. in copper, iron, or steel pipe up to $\frac{1}{2}$-in. thickness.

Class "C": for pipes, 12 in. to 30 in. in copper, iron, or steel pipe, up to $\frac{1}{2}$-in. thickness.

List Giving the Average Time taken to Expand and Flare into Flange, and Face off the Ends of Iron or Steel Pipe, by the "Lovekin Expanding and Flanging Machine."

(Flanges are furnished, bored and faced, complete.)
(Time includes handling of Pipe and Setting Flange.)
Class "A" Machine: (One Man Only—No Helper).

Diameter of Pipe.	Thickness of Material, Iron or Steel.	Average time in minutes, including Setting.
2 in. ...	$\frac{1}{8}$ to $\frac{3}{16}$ in. ...	8 minutes.
$2\frac{1}{2}$,, ...	$\frac{1}{8}$ to $\frac{3}{16}$,, ...	9 ,,
3 ,, ...	$\frac{1}{8}$ to $\frac{3}{16}$,, ...	10 ,,
$3\frac{1}{2}$,, ...	$\frac{1}{8}$ to $\frac{1}{4}$,, ...	11 ,,

Fig. 6.—Steel Pipe Extruded on the Lovekin Machine.

4 in.	...	$\frac{1}{4}$ in.	... 12 minutes.
$4\frac{1}{2}$,,	...	$\frac{1}{4}$,,	... 14 ,,
5 ,,	...	$\frac{1}{4}$,,	... 16 ,,
$5\frac{1}{2}$,,	...	$\frac{1}{4}$,,	... 18 ,,
6 ,,	...	$\frac{1}{4}$,,	... 20 ,,
$6\frac{1}{2}$,,	...	$\frac{1}{4}$,,	... 22 ,,
7 ,,	...	$\frac{1}{4}$,,	... 24 ,,
$7\frac{1}{2}$,,	...	$\frac{1}{4}$,,	... 26 ,,

CLASS "B" MACHINE: (ONE MAN AND HELPER).

$5\frac{1}{2}$ in.	...	$\frac{1}{4}$ to $\frac{3}{8}$ in.	... 15 minutes.
6 ,,	...	$\frac{1}{4}$ to $\frac{3}{8}$,,	... 16 ,,
$6\frac{1}{2}$,,	...	$\frac{1}{4}$ to $\frac{3}{8}$,,	... 17 ,,
7 ,,	...	$\frac{1}{4}$ to $\frac{3}{8}$,,	... 18 ,,
$7\frac{1}{2}$,,	...	$\frac{1}{4}$ to $\frac{3}{8}$,,	... 19 ,,
8 ,,	...	$\frac{1}{4}$ to $\frac{3}{8}$,,	... 20 ,,
9 ,,	...	$\frac{1}{4}$ to $\frac{3}{8}$,,	... 21 ,,
10 ,,	...	$\frac{1}{4}$ to $\frac{3}{8}$,,	... 22 ,,
11 ,,	...	$\frac{1}{4}$ to $\frac{3}{8}$,,	... 23 ,,
12 ,,	...	$\frac{1}{4}$ to $\frac{1}{2}$,,	... 25 ,,
14 ,,	...	$\frac{1}{4}$ to $\frac{1}{2}$,,	... 27 ,,
16 ,,	...	$\frac{1}{4}$ to $\frac{1}{2}$,,	... 30 ,,

CLASS "C" MACHINE: (ONE MAN AND HELPER).

12 in.	...	$\frac{3}{8}$ to $\frac{1}{2}$ in.	... 25 minutes.
14 ,,	...	$\frac{3}{8}$ to $\frac{1}{2}$,,	... 27 ,,
16 ,,	...	$\frac{3}{8}$ to $\frac{1}{2}$,,	... 30 ,,
18 ,,	...	$\frac{3}{8}$ to $\frac{1}{2}$,,	... 35 ,,
20 ,,	...	$\frac{3}{8}$ to $\frac{1}{2}$,,	... 37 ,,
22 ,,	...	$\frac{3}{8}$ to $\frac{1}{2}$,,	... 40 ,,
24 ,,	...	$\frac{3}{8}$ to $\frac{1}{2}$,,	... 45 ,,
26 ,,	...	$\frac{3}{8}$ to $\frac{1}{2}$,,	... 50 ,,
28 ,,	...	$\frac{3}{8}$ to $\frac{1}{2}$,,	... 55 ,,
30 ,,	...	$\frac{3}{8}$ to $\frac{1}{2}$,,	... 60 ,,

Copper pipe requires one-third less time.

Larger sizes than those given are special.

Thickness of material over that given above is special.

SS. "NORFOLK" UNDER SAIL.

THE loss of the propeller blades and the improvised measures adopted by the captain for sailing the *Norfolk* a distance of about 800 miles, revives the question as to the advisability of providing spare gear for single-screw steamers, in the shape of sails, and means to fit them in an emergency such as happened in the *Norfolk*. The tendency in recent years has been to dispense with masts and other appliances for sailing, and to provide masts on posts simply to hang derricks for cargo purposes. The captain of the *Norfolk* did his best with what he had at hand on board, and between canvas awnings and hatch coverings he ultimately made sufficient headway with much labour to reach the station, which he signalled, and the vessel was towed into port.

The cases of broken shafts are not so infrequent that they should be passed over as of too rare an occurrence to require consideration in the matter of safeguarding against, as far as possible, by providing sails and gear to fit them. It is a question of risk, and whether the cost of sails and appliances is justified in the original outlay and outfit of the vessel. In many cases possibly now, when steamers are run with a minimum of men on the crew list, the exercise necessary occasionally during the voyage to put them up and keep them in order might not be undertaken, yet that very exercise would be a good thing for the crew, while for the appliances themselves it is absolutely necessary, so that if, and when, the emergency arose, all should be fit and ready, as sails kept in a locker, without being brought out for exercise from time to time, soon perish. There are instances on record where steamers with broken shafts or the loss of the propeller, have been sailed long distances under sail and under considerable disadvantages in some of the instances.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Hamburg American Line

IS certainly well managed in most of its departments. Their publications, for example, are of a high standard, both in literary and artistic merit. The pamphlet which came out some time ago to record the advantages of the Ritz Restaurant aboard the liner *Amerika* was a remarkable production, whilst that which describes the later vessel, the *Kaiserin Auguste Victoria*, is equally artistic, though, unfortunately, it does not appeal so forcibly to the average Englishman, being as yet only published in German. The ship generally is described at some length, and illustrations are given of the palm-room—which is a remarkable apartment enough to be found at sea. It also gives sketches of many little corners in the ship and of some of the specially-designed furniture. As I looked over the illustrations of artistic bas-reliefs, of large and beautiful paintings, of sofas and easy-chairs of the most elegant design, my mind could not help going back to the early liners which one's predecessors in journalism described as "floating palaces." No doubt they thought, as we think to-day, that the last word has been said in elaboration of detail and in provision of luxury. Yet it seems difficult to imagine how much advance can be made on the practice of the early twentieth century. One little thing that struck me as especially neat is a large threefold wardrobe. The left-hand and centre compartments are a wardrobe proper, whilst the right-hand one masks the washhand basin and toilet requisites. A large sheet of looking-glass in the middle door appeals to the lady passengers. It is noticeable that the lower part of the glass is protected from possible injury by an ornament grill, which in no way detracts from its usefulness. What an amount of thought and skill is represented by this one design!

An appendix gives some interesting statistics regarding the big ship. She is provided against every eventuality—the Hamburg-American Line theory being, like that of the Cunard Company, to omit no step which may conduce to safety. Some other owners have been known to work on the opposite policy, and to remark that "their ships were made to keep afloat," putting this fact forward as a good reason for not providing exceptional safeguards. I am led to this observation by reading that of the six dynamos with which the ship is provided, one is carried high above the water-line so that in case of the flooding of the engine-room there will not be the added trouble of darkness throughout the ship. The crew is enormous, comprising altogether no less than 588 persons. But the details of the engines and auxiliary machinery show what an immense staff is needed to look after that department even if the ship be not one of the racing type.

With this book I also received a copy of another pamphlet, entitled, "Sixty Years of Ocean Navigation." This gives a readable account of the rise and progress of the company. It is, indeed, a remarkable record. The gross tonnage of the fleet is not only far larger than that of any other steamship company in existence—the other great German company, the Norddeutscher Lloyd coming second—but it is larger than the aggregate of most national Mercantile Marines. The Hamburg directorate are now in a position to speak of their steam tonnage as not so far short of that of France! This great expansion has been a thing of comparatively recent date. The fleet is still being largely increased. The company is very prosperous, paying for last year an 11 per cent. dividend, and it has work for all its vessels, so that it is likely to grow to even greater importance.

It is not, however, true that the board has placed an order for a ship to surpass the great Cunarders. One would hardly imagine that the rumour was probable. These ships mark so great an advance in dimensions and speed, that wise business men, like Herr Ballin and his co-directors, will most certainly wait to see how the *Lusitania* and *Mauritania* turn out before they attempt to commence anything to rival them.

The extensions of the company go on almost month by month. The other day an attack was made on the Nile trade, so long a lucrative British preserve of tourist traffic. Then followed the Persian Gulf service, which may have

important results politically. Now we have the announcement that at the beginning of September a new service will be inaugurated by one of the Prinz type of steamer between Genoa and the River Plate. Thus more and more the Mediterranean trade tends to get into German hands, and one day there will be an outcry for a German port on the Mediterranean.

Meanwhile, Dover is suffering an eclipse. Time alone will show whether it be temporary or no. The directors of the Hamburg American Line, shortly after the extent of the damage to the *Deutschland* was appreciated, gave forth a notice that in the immediate future the call at Dover by their big passenger steamships would be abandoned, a return being made to the Solent. Care was taken to add that this was but a temporary departure, necessitated by the unfinished state of the National Harbour works. But I should somehow be surprised to see the return of these big ships to the Kentish port, for it is alleged that, besides this actual accident, there have been several narrow escapes from disaster on account of the swirl which vessels encounter when passing from the Straits into the protected area within the breakwaters. The eddies and swirls now noticeable are attributed to the unfinished state of the works. Unfinished the works undoubtedly are; but one must take the liberty to doubt whether the completion of the breakwaters will lessen the trouble. One would imagine that as the breakwaters are completed, and the passages between them consequently narrowed, the currents, which cannot be lessened in volume, and which must continue to flow in and out of the harbour, being more and more restricted in their path, would tend to run with more and more violence. Anyhow, for the present, Southampton has reclaimed her visitors.

The White Star Line

is reported to have disposed of two of its older steamships to the Pacific Mail Steamship Company of San Francisco. These are the single-screw liners *Coptic* and *Doric*, built some five-and-twenty and three-and-twenty years ago respectively, at Queen's Island. The *Coptic* is of just under 4,400 tons gross register, and the other vessel is a couple of hundred tons larger. Both vessels were originally fitted with the compound tandem engine characteristic of the line's design in the pre-triple-expansion engine days. But in 1894 the *Coptic* was fitted with new engines of the triple-expansion type, and boilers calculated to supply steam at a suitable pressure. A year later the *Doric* was similarly treated. At one time each of these ships was engaged in the London and New Zealand passenger service, but of recent years they have been on the San Francisco and Hong Kong route by arrangement with the Occidental and Oriental Company. Whether the White Star Line's long connection with this company is now terminated, or whether other ships are to be sent out to replace the *Coptic* and *Doric* has not yet been made public.

The Union Castle Line.

I had a pleasant little trip in mid-August from London to Southampton in the Union Castle Line's intermediate steamship *Dover Castle*. The vessel is one of three sisters, *Dover Castle*, *Durham Castle*, and *Dunluce Castle*, built respectively by Messrs. Barclay, Curle, & Co., the Fairfield Shipbuilding Company, and Messrs. Harland & Wolff, and it is interesting to note the little differences by which the individuality of the three great firms named displays itself. Fine comfortable ships they all are, of over 8,000 tons register, having twin screws, with excellent accommodation for first and third class passengers, the latter being carried according to the company's modern practice, in closed berths. It is noticeable that the recent sales of their older ships, coupled with certain engagements for some of their cargo liners, has largely reduced the number of Union Castle liners in the docks. When the *Dover Castle's* passengers arrived at the docks on the Thursday night there were five vessels of the fleet in the dock. Of these two, the *Dover Castle*, outward bound, and the *Berwick Castle*, for Continental ports to load, left on Friday morning's tide, whilst the *Goth* was preparing to load in dock. Thus but two ships, the *German* and the *Newark Castle*, remained. At Southampton, again, but two ships now lie off Netley. One of these, the *Dunvegan Castle*, is the reserve ship of the mail service, ready to take her place should anything befall any of the larger ships regularly sailing on the station, whilst the comfortable *Dunvegan Castle* seems to be awaiting a purchaser. The company would thus appear to have adapted its fleet to the present quiet times in South Africa, whilst getting rid of practically all their older and less economical tonnage. But they have, at the same time, provided themselves with newer vessels which will be ready and able to cope with the larger business which the return of good times must soon bring them. Going down Channel we saw a sight which few voyagers will ever see again. Off Margate we met the steam tug *Oceana*, of Messrs. Watkin's Line, with a big wooden man-of-war in tow. The latter had her lower masts standing, and showed a number of lofty ventilators. She proved to be the old *Boscawen*, long used as a training ship at Portland. She was formerly a 120-gun ship, and was on her way to the shipbreakers on the Thames.

At Southampton I had the opportunity to go round the docks and see the *Deutschland*, in the new Trafalgar graving dock, making good the damage which she sustained at Dover last month. There seemed to be a large number of troopships about the port, including the P. and O. *Plassey* in the Prince of Wales dry dock, and the *Rewa*, the large new turbine-engined British-India boat, looking very smart off Extension Quay. Southampton, on a Saturday, is a busy place with Union Castle steamships, for there is the arrival of the inward mail steamer in the morning, the departure of the intermediate liner soon after noon, followed, some three or four hours later, by the despatch of the mail steamship.

The Cunard Company.

There have been persistent rumours in regard to the Hungarian branch of the Cunard Company's Atlantic service. It seems to be the fact that there is a strong local desire for the establishment of a National line from Fiume to New York. There is, however, no room for such a company whilst the Cunard Line maintains its present excellent service of large and fast liners. This fact seems to have been recognised by those who circulated the reports, for they alleged that Hungarian officials were on their way to London to make terms with the Cunard Company for the abandonment of its conract, adding that these would include the purchase of the fleet which had been provided for the service. But the Cunard Company met all these statements with a prompt contradiction.

It has now been announced that Messrs. C. S. Swan & Hunter & Wigham Richardson will launch their 25-knot Cunard mail steamer, the *Mauritania*, at Wallsend, on September 20th.

The Manchester Ship Canal.

has issued its forty-second half-yearly report. This seems to show a steady development of its trade. Compared with the corresponding half of 1905 there is an increase of £24,431 in receipts, whilst the weight of sea-borne merchandise paying toll is nearly a quarter of a million tons larger. Whilst there is this increase in receipts there is no corresponding increase in expenses, these being up little over £5,000. Another £1,000 has been spent on dredging—a needful outlay enough—and nearly £1,200 is the addition to the burden of rates and taxes upon the undertaking. This increase in rates is a serious matter enough for all British enterprises, though from its history one is inclined to have less sympathy on this head with the Ship Canal than with most other undertakings. Two important trades are being opened up by the management. One is the milling trade, which has already made a practical beginning, important mills having been opened on sites adjacent to the waterway. These must be permanent and growing customers. Then there is an endeavour to get frozen meat landed at Manchester direct. If the talked-of sorting chamber can be constructed and the trade established, it should be of great use to the Canal, for the vast population of which Manchester is the centre, or rather the figurehead, must be a large and growing consumer of foreign meat. In view of the effect on the steamships using the Canal of the recent alteration of the Board of Trade Freeboard Tables it has become necessary to press on the work of deepening the Canal to a minimum depth of 28ft. Generally it may be said that the increase in traffic of the waterway is steady though slow. The chairman in his speech made one remark which might be taken to heart by those concerned with the Port of London. "In point of fact," he observed, "no port can, in these days, keep its traffic, let alone get any increase of traffic, unless it is kept up to date, and is as ready and efficient for all classes of traffic as competing ports."

Argentina and the Live Cattle Trade.

Speaking of the meat trade brings one to a reference to the discussion which has been going on in the press in reference

to a project for using the island of Alderney as a depôt for Argentine meat. The idea is to establish abattoirs on the island, and to bring thither live cattle from the Argentine, kill them, and prepare them for the English market. The reason for making such a depôt lies in the fact that, owing to the alleged prevalence of foot-and-mouth disease in the South American republic, the Board of Agriculture will not allow live cattle to be brought thence to England for fear of infection of our home stock. The probability would seem to be that the farmers of Alderney, who are so famous for their breed of cows, would have to be prepared to lose their cattle. But there are suggestions made as to possible large scale compensation. Alderney is a small place, and its revenues do not exceed £1,100 per annum. A fine prospect is held out to the islanders. A sum of £10,000 would be invested to meet possible loss through an outbreak of disease, whilst the farmers would, whether disease broke out or not, be subsidised by the company at the rate of £1 a year for every head of cattle now in the island. Besides this, there is the prospect of work and remuneration on an unprecedented scale. It is estimated that the abattoirs would find continuous employment for from 200 to 250 men, whilst the company would spend sums reckoned at £35,000 to £40,000 in the island. The States would find their revenues quintupled, and their communications with the mainland much improved by the constant visits of the vessels which would market the prepared meat.

This picture is a tempting one for the island. But the Board of Agriculture has sounded an alarm. It contends that, if Alderney were allowed to make itself the headquarters of such a trade, there would be a probability that it would be infected with foot and-mouth diseases, with the consequence that Jersey might also be contaminated, or, at least, find its trade in dairy cattle placed under an embargo. Further, it is asserted that there might be a risk even to the cattle in Great Britain. The promoters of the scheme, of course, reply that these dangers, if not wholly imaginary, are, at least, greatly exaggerated. There the matter stands for the moment. But the scheme, if carried out on the proposed scale, would have a large effect on the shipping trade from the River Plate.

The Thames Steamboat Service.

Even unlimited—or what they take to be an unlimited—credit, has not enabled the London County Council to continue its service of river steamboats. During last winter one recorded time after time heavy deficits. Deficits may, perhaps, be expected in a new service. But, in this case, the signs were all against success. For whilst the expenditure was necessarily heavy and continuous, there was no sign of improvement in the tiny takings recorded. The weight of public opinion made itself at last felt in the measures taken to reduce the number of winter sailings. Later on an attempt was made to, at least in part, save the situation by the arrangement entered into with the private company which also uses the waterway. But at the beginning of August the Rivers Committee, taking its courage in both hands, made a recommendation to the Council that the fleet should be laid up for the winter on October 2nd, and that all hands not needed to tend the vessels in their winter quarters should be discharged. This will, of course, be done. But the chairman of the committee, Sir John MacDougall, admitted in so many words that the "service had been a failure!" He proposed during the recess to consult with the managers of other services, offering rival means of locomotion, to see whether a working arrangement might not be come to which might save the situation. But there would seem to be no hope of real success. The fact is the river was a fine road, and offered a cheap means of transit in the old-fashioned days of locomotion. But now, with fast motor-omnibuses, with the District railway running along its course, and with the various other opportunities offering to different classes of passengers, there are but a few left to whom the river appeals, and even these are not regular passengers.

When on board the *Dover Castle* the other day I observed a melancholy fleet of the older Thames steamboats packed away in a basin at Blackwall, evidently awaiting the inevitable shipbreaker.

A very serious Matter,

as well for engineers as for deck officers, is the proposed interference with the discipline of ships' crews by the Board of Trade's new regulations. The suggestion is that officials of the unions should be allowed to be present at Mercantile Marine offices when seamen and firemen are in process of being engaged or discharged. Further, that these officials shall not only be allowed to be present, but to take part in discussions which may arise between the men and the representatives of their employers. Thus one may be sure that no deductions in the way of fines will be allowed to pass undisputed, whilst any technical loophole, left by the officers of the ship under the stress of maritime difficulties, will be taken advantage of to the full on the men's account. There is difficulty enough already in maintaining discipline at sea, and we may be assured that the new move of the Board of Trade, if carried into effect, will gravely affect the matter, and still further prejudice the work of shipowners and officers in carrying on their lawful occupations.

Disasters.

There have been some serious disasters to merchant shipping recently. Amongst them there was the stranding of the Italian emigrant steamer *Sirio*, off Cape Palas. The wreck seems to have taken place in fine weather and on a clear afternoon. It was probably due to an attempt on the part of those charged with the navigation of the vessel to shave corners and go too close to a well-known danger. There seems to have been no less than 865 persons on board. At first it was reported that 385 of these, including but fourteen members of the crew, were lost. But there were, fortunately, many craft in the vicinity, and these all hastened to render aid. Accordingly, the tale of loss has been considerably reduced, though it still falls not far short of 200 persons. Extraordinary stories of the fighting aboard the ship after she went on the rocks have been circulated; but these must be taken with a considerable grain of salt. For we have here to deal not only with the imaginative reporter on the look-out for sensational copy, and with the emigrant, whose first taste of the sea has brought him to a disaster terrifying enough to unsteady the strongest nerves of the experienced mariner, but we have also to allow for the mercurial temperament of the Southern races. Anyhow, the captain seems to have been saved, and an inquiry is promised.

Another disaster to an emigrant ship was the stranding of the *Brooklyn*, of the Luchenbach line, when entering the port of St. Michael's, in the Azores. There she remained for nearly a fortnight, but there were strong hopes of re-floating her. These were realised on August 21st. Meanwhile, the passengers have been sent on to New York by another conveyance.

Then there has been the stranding of the fine new American liner *Manchuria*, of some 13,000 tons, near Honolulu. She belongs to the Pacific Mail Steamship Co., and is, of course, a very valuable vessel, and the accident is being watched with considerable anxiety by underwriters, since, whether she prove a total loss or not, there are bound to be considerable claims in connection with the casualty. The position is a difficult one, the vessel having passed inside the reef, where she took up a position broadside on, rolling heavily. Not only is she holed in several compartments, but her main steampipe burst, disabling the port set of engines. This latter damage seems to indicate considerable straining of the fabric of the ship.

A Story,

which would be incredible if it were not true, relates to the expedition on which the steamship *Xema* has just set sail with sealed orders. The vessel in question spent a long and useful working life in home waters, and then entered the fleet of Earl Fitzwilliam when that adventurous peer went on his fruitless expedition to find buried treasure in Cocos Island. Since her return to this country she has apparently been resting. Now she has been acquired by a syndicate for the purpose of carrying out a search even more romantic than that of the Earl. It appears—so the story goes—that a shipwrecked sailor brought home some pebbles which he had picked up on a desert beach. He did not attach any value to them, but thought them uncommon. For some reason, however, he eventually submitted them to an expert, and learnt that they were diamonds! As he knew, according to the story, that these stones composed the whole of the large beach whence he took them, there were great possibilities in his knowledge. A map indicating the situation of the beach was made by him and bought by a powerful and influential syndicate. By them the *Xema* has been fully equipped with everything likely to be of use in their search, including machinery, explosives, and a quantity of arms. How far this story is

true one cannot know at present. At all events, respectable papers have published the facts which I summarise, and there is no doubt that the *Xema* has gone to sea with her big complement of men and a very warlike equipment.

The Canadian Government

is certainly doing what it can to minimise the dangers incident to the navigation of their coasts and of the River St. Lawrence. To keep the latter waterway open as late and as early as possible during the ice season, they are providing an ice-breaker, designed on the "Ermack" model. This vessel has just been launched by Messrs. Vickers, Son & Maxim, and she should be in a condition to begin her practical efforts at opening a channel through the ice of the St. Lawrence during the coming winter.

Then in regard to the development of wireless telegraphy, it has recently provided two new stations on the St. Lawrence, one being at Father Point, and the other at Seven Islands. These make a chain of eight stations on the course of the river, and insure that no vessel fitted with a wireless installation shall ever be out of touch with one or other of the points. In addition, of course, to these St. Lawrence stations, there are several others, notably that at Cape Race, which tend to guard the ocean seaboard of the Dominion.

The West India Royal Mail Company

can certainly boast of an energetic chairman. It is not long since he and Mrs. Phillips visited the West Indies, and now South America is to be looked up in the interests of the company.

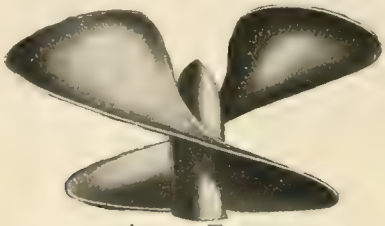
In a modified form, too, it must be recorded that the West India mail contract has been restored to the old contractors. Provision has been made for a fortnightly service, to be maintained by the company's steamships between British Guiana, Grenada, St. Vincent, and Barbados, at which latter point connection will be made with the Southampton liner. From Barbados, too, there is a fortnightly service to Dominica and St. Lucia, whereby those islands are connected with the mail service.

Again, arrangements have been entered into with the firm of Messrs. Larrinaga, of Liverpool, whereby the service so long maintained by them between the Mersey and Havannah will be transferred to the West India Company. Messrs. Larrinaga will still be connected with the service, as they will continue to act as local agents for the Royal Mail Co., but it is said that the steamships to be employed will in future be those of the Southampton company.

TRUSS' PATENT PROPELLER.

WE illustrate, in the adjoining diagrams, a new form of propeller, which is put on the market by Messrs. T. F. J. Truss & Co., of 60, Mark-lane, London, E.C.

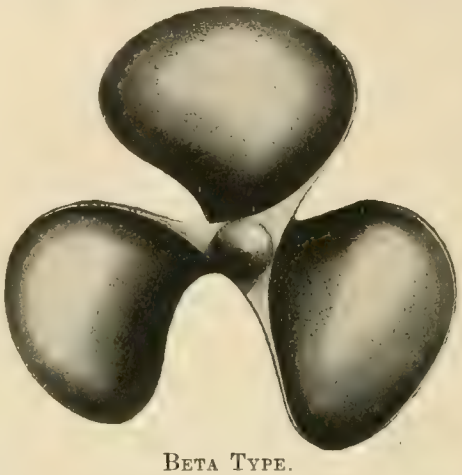
This propeller is of the induction type—*i.e.*, it takes its water-feed inwardly from the periphery as well as at the end, and it discharges the same in a slightly conical column rearwardly, thus exercising a high pressure over a small area. It will be noticed



ALPHA TYPE.

from the illustrations that the Truss propeller is designed with an increased area at the periphery, or end of the blade, and a reduction of area near the boss, and it is claimed in consequence of this particular design, that a considerable increase in the maximum speed of the ship is obtained, and a reduction in the number of revolutions required to obtain such speed also results. It will be recognised that, by increasing the width of the end of the blade, the designer is reverting to the earlier forms of prepeller made, but it may be reasonably pointed out that the conditions of to-day are very different from what they were forty, or even fifteen years ago; also, it is now recognised that the locality of the propelling surface is of as great importance as the proportion of area of that surface to the maximum I.H.P. for one square foot of surface at or near the periphery is equivalent to at least eight square feet at or near the semi-radius of the blade.

The results of practical experience have shown that the proportion of power expended on overcoming the



BETA TYPE.

rotational resistance in the ordinary forms of propellers rises with the increase in the number of revolutions. This, it must be recognised, is a matter of paramount importance, to which little attention appears to have been paid hitherto. It is contended, and quite rightly, that the reduction of the rotational resistance of the propeller and the utilisation of the power so saved to the direct propulsion of the ship must naturally be a definite and decided gain; and it is with this aim in view that the Truss Propeller has been designed, so that the rotational resistance is reduced to a minimum, and a considerable increase of speed has been the result. It is pointed out that the peculiar construction of the helicoidal blades of this propeller enables the stream lines, or the water displaced by the forward motion of the ship operating with angular velocity against the non-propelling faces of the blades, to counterbalance the rotational resistance, and at the same time prevent cavitation and churning, and in support of this feature we are informed there is little motion on the surface of the water astern, and comparatively no wash is produced. We understand that the results of numerous tests on various types of the Truss Propeller over the measured mile have shown increases ranging from 20 per cent. to 35 per cent. in speed, and a saving in energy of 15 per cent. to 25 per cent. over existing forms of propellers.

Messrs, James Walker & Co., "Lion" Works, Garford-street, West India Docks, London, E., sole patentees and manufacturers of the celebrated "Lion" (Patent) Gold Prize-Medal Packings for all pressures of steam and water, will show at their stand No. 130 (main entrance) of the Engineering and Machinery Exhibition, at Olympia, a full "range" of their highly successful packings, jointings, mechanical rubber goods, valves, "Cone" gauge glass rings, hose, &c.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondents at home and abroad.)

The Naval Programme.

AS is now customary, the Shipbuilding Vote—perhaps the most important part of the Estimates—was presented to Parliament at such a late date that scarcely any time of the session remained for its discussion. There has, however, been plenty of discussion in the Press, and there can be no doubt that, although, for the moment, the country accepts our naval position as satisfactory, this happy state of affairs is not likely to continue if there are further evidences of retrenchment and parsimonious cutting-down of expenditure. The programme of four armoured vessels, of which three were to be "Dreadnoughts," and one a cruiser of the "Invincible" class, has now been reduced to the three "Dreadnoughts," the cruiser being knocked off the programme. In addition, money was voted for five ocean-going and twelve coastal destroyers, but two of the former and the whole of the latter have now been postponed. Also, out of the twelve submarines that were in the Estimates, only eight will be built. The actual reduction in money on the year's estimates is not large, but, measured against the total liability represented by the ships which are struck out of the programme, there is a saving of about two and a half millions. It is understood, however, that the Government is quite prepared that if no adequate response is made to its advances at the Hague Conference to be held this year it will enlarge the programme proposed for 1907-8, increasing it proportionately. This is unquestionably a fair way to look at the matter, regarded, of course, in its widest aspect, but there are other points of view which wise and far-seeing legislators would take into account. It will not be easy to bring about a restoration of the facilities for building up a Navy when our gun and armour manufacturers, our shipbuilders, and other large leaders of enterprise connected with these industries cease to put their capital into unremunerative plant.

Portsmouth Dockyard.

I have said all along that the new vessel to be built here would be another "Dreadnought," and this has now been borne out by Mr. Robertson's statement. Of course, it has given great satisfaction to hear the official pronouncement, and we are ready to commence building operations as soon as the word is given. The remaining pair of the *Dreadnought's* 12-in. guns arrived at the end of last month. She presents a singular appearance compared with other battleships, two tripods, with a fire-control station on each, taking the place of masts. The vessel had the honour of being visited by the King and the Prince of Wales on the 4th ult., in No. 15 Dock, where she was placed the previous day for the remainder of her fittings to be put on board. The Royal visitors, both of whom were in naval uniform, were accompanied by Rear-Admiral Sir Henry Barry, Engineer Rear-Admiral Corner (manager of the chief engineer's department), and Mr. T. C. Mitchell, manager of the constructor's department, and the party were shown round by Captain Bacon. The Royal visitors made a critical examination of the huge vessel, including a visit to the engine-room. They also paid a visit to the *Victory*. The *Dreadnought* was commissioned on the first of the month by Captain Bacon for the Reserve Division, but it is not probable that she will be ready for her trials before the end of the month. In November, Sir Henry Barry, our Admiral Superintendent, goes to the Mediterranean to take command of the Third Cruiser Squadron, in succession to Sir Hedworth Lambton, and his place will be taken here by Rear-Admiral Spencer Login, who was, not very long ago, captain of the Royal Naval Barracks at Portsmouth. While we are, of course, glad to see Admiral Barry get a sea appointment, we shall be very sorry to lose him, for he is most popular with the dockyard men. The cruiser *Hermione*, of the Reserve Division, is to be overhauled, as she is to be commissioned for foreign service in February. When submarine *A6* grounded on a sandbank in Sandown Harbour, on the last day of July, she, luckily, was got off at high tide, and came back into harbour not much the worse. Submarine *B4* was not so fortunate. On the 21st ult., as she was coming into harbour, she collided with an outgoing dredger, and was seriously damaged, she having to be beached and afterwards docked for repairs. The battleship *Hindustan*, which has been here since the beginning of July, was expected to have been ready to rejoin the Atlantic fleet on the 6th inst., but it was found that she had been badly strained astern, this being probably due to her having been improperly shored up when in dock at Gibraltar. She will take some months to put right. Some of the London papers discovered a veritable "mare's nest" concerning the *Good Hope* after that cruiser had been docked. The fact was that at the commencement of the manœuvres the vessel touched ground when leaving Plymouth, but the slight damage she sustained was not sufficient to prevent her taking part in the operations, and at the conclusion of the manœuvres she returned here, was docked, and had half a dozen plates replaced. The battleship *Duncan* did sustain some damage, and narrowly escaped the fate of the *Montagu*, for, while assisting in the salvage operations, she touched rock, and damaged her hull badly. She is now in dock, and her repairs will take some time. The *Britannia*, which has just completed her trials, is to relieve the *Majestic* in the Channel Fleet, that vessel being ordered to pay off here on October 1st. The *Prince of Wales*, which has been here some time undergoing a refit, leaves on September 8th to rejoin the Mediterranean Fleet.

The "Lord Nelson."

The battleship *Lord Nelson* will be launched from the yard of Palmer's Shipbuilding Company, at Jarrow, on September 4th by Viscountess Ridley. That event will be remarkable in that she is the last battleship for the British Navy remaining on the stocks, either in the Royal or private yards. Her sister ship, the *Agamemnon*, was launched from Messrs. Beardmore's yard on the Clyde a couple of months ago, and these two vessels mark an intermediate stage between the *Dreadnought* and the *King Edward*. The *Lord Nelson* and the *Agamemnon* have four 12 in. guns and ten 9·2 in. guns, whereas the *Dreadnought* will carry ten 12-in. guns. In addition, they will be armed with thirteen 12-pounder quickfirers, twenty 3-pounders, two maxims, and five submerged torpedo-tubes. Their displacement will be 16,500 tons, and their engines will develop 16,750 I.H.P., which it is anticipated will give a speed of 18 knots, one knot slower than the *Dreadnought*. As to protection, they carry a water-line belt of 12 in. in thickness amidships, reduced towards the stern to 4 in., and 6 in. in the bows. In the central part of the ships, above the water-line, 8-in. armour protects the upper deck, and the protection athwartship against raking fire from ahead or astern is 12 in. in thickness, the conning-tower protection being the same. The principal dimensions of the vessels are: Length, 410 ft.; beam, 79 ft. 6 in.; mean draught, 27 ft. The first *Nelson* built for the Navy (the name was without the prefix) was built at Woolwich, in 1814, and was the largest wooden line-of-battleship ever built in this country. Her overall length was 244 ft., and her length on the gun deck, 205 ft. Her extreme beam was 54 ft. 6 in., and she drew 24 ft. forward and 25 ft. aft, on a measurement of 2,617 tons. Her depth to the upper part of the taffrail was 65 ft., and her armament consisted of 112 carriage guns and 18 carronades. The figure-head was a bust of Nelson, supported by Fame and Britannia, and bore as a motto the Trafalgar signal. There have been two other *Nelsons*. One was lent to Melbourne for the defence of that colony in the seventies. The other, which was built in 1880, is a vessel of 7,000 tons, and she was the first flagship of the late Admiral Sir George Tryon on the Australian Station. She is now at Portsmouth, engaged in the training of stokers.

Chatham Dockyard.

As was predicted here three or four months ago, Chatham's main work next year will be the building of submarines. This has been officially announced, and we are to have eight included in this year's estimates, instead of two, as originally intended. We are anxiously waiting to hear when they are to be commenced. Meanwhile, several small jobs are forthcoming, the latest order being for three oil-tank lighters of 500 tons capacity. This will provide work for some of the hands which have been released by the completion of the *Africa*. That vessel left on the 21st ult. for her steam and gunnery trials, and was to return on the 31st. Some minor defects, however, have developed, and she is to return for these to be put right. The *Africa* is

expected to shortly take the place of the *Victorious* in the Channel Fleet. Mr. Lamb, the member for Rochester, visited the yard a few weeks ago, by permission of the Admiralty—who, by the way, gave him every facility, and told off two officials to accompany him—to see what the possibilities of the yard are with regard to building large vessels of the "Dreadnought" type; so I suppose, when a chance occurs, he may say something on the subject at St. Stephen's. Naturally, we do not think much of the economies which have been announced. As a set-off against the saving to be effected, a large amount of valuable plant —and a number of machines have been lying idle here for some time—will be practically useless by the time they are again required. A well-known figure has just retired—Lieut. Hackney, who for nearly five years had been in charge of the breech-loading gun-mountings. When appointed he held the rank of chief gunner, but, upon promotion to commissioned rank, two years ago, he was continued in the appointment, convincing proof of the satisfactory manner in which he discharged his duties. His successor, Chief Gunner Holman, is the author of several books dealing with life in the Navy. The *Black Prince*, of the Second Cruiser Squadron, arrived at the end of last month to have some further work carried out in connection with her fire-control fittings. The work, however, only occupied about a week, and she has since rejoined the squadron. The battleship *Africa* left on the 21st for the Channel to carry out her armament trials. She also underwent a twenty-four hours' final steam trial preparatory to the acceptance of her machinery from the contractors, and, in addition, carried out oil-fuel tests, and returned on the 31st. The cruiser *Antrim* arrived on the 8th ult., on the conclusion of her visit to Antwerp, to have some repairs effected, and she has been docked for an examination of her underwater fittings. Her skipper, Captain E. F. Inglefield, is to be congratulated on his appointment as secretary of Lloyd's; he has handed over the command to Captain Pakenham. The *Sutlej*, of the Particular Service Squadron, having had the alterations in her fire-control completed, left on the 16th ult., to rejoin the squadron for a cruise to Norway. The destroyer *Thrasher* is having the damage made good which she sustained by running on a rock in Bantry Bay; she arrived on the 8th from Haulbowline, where temporary repairs were effected. The surveying vessel *Goldfinch*, now at Devonport, is to be docked here instead of at that port, as was at first expected. The battleship *Swiftsure* left on the 23rd to rejoin the Channel Fleet, calling at Sheerness to embark War Department stores. Preparations are being made for the launch of the cruiser *Shannon* next month. The vessel will be in a far more advanced state than has usually been the case here, and, as she will be the largest ship ever launched at this yard, the event is likely to be of extra special interest.

The Motor Torpedo-boat.

The new motor torpedo-boat designed and constructed by Messrs. Yarrow, and purchased by the Admiralty, has caused much interest at Portsmouth, where she has been delivered. During the Cowes week she was on view in the Solent, where the King and Queen, attended by Sir John Fisher, made several trips in her. The propelling machinery of this little vessel consists of three sets of internal-combustion engines of the Napier type, working the Otto cycle, and each of them working its own screw, the total power developed being 300 I.H.P. The size of the boat is 60 ft. long, by 9 ft. beam, and one of the remarkable features of the new craft is her radius of action. A second-class torpedo-boat of 12 tons, driven by reciprocating engines capable of attaining a speed of 18 knots, and carrying three tons of coal, could run 100 miles. The motor-boat carries two tons of petrol, and with this she can maintain 26 knots for 600 miles. Her weight is eight tons, and her draught only 12 in., this being due to the fact that she is flat-bottomed. It is to this latter that her high speed is attributable, for when going at full power she rises on the surface and practically skims from wave to wave. She is fitted for carrying and discharging two 18-in. Whitehead torpedoes. The cost of the vessel has been stated at £2,000, but I understand it is just double that amount. The one disadvantage of such small vessels is their inability to keep the seas, but they will, no doubt, be of value for port defence. The argument that so many hundreds of them could be built for the price of one *Dreadnought* therefore falls to the ground. However, such a vessel could be easily transported, and it should have a value for defensive purposes and be able to play a part in many of our future naval operations. The danger connected with the use and storage of petrol will, no doubt, be surmounted.

Sheerness Dockyard.

We had two Royal departures last month. On the 14th the King left in the *Victoria and Albert* for Flushing *en route* to Marienbad, escorted by the cruisers *Devonshire* and *Roxburgh*; and on the 11th the Queen embarked in the royal yacht for her visit to Norway and Denmark, escorted by the latter cruiser. There is a prospect of some work coming which was quite unexpected. The Admiralty recently requested estimates to be prepared here of the cost of removing the engines and boilers of the battleship *Alexandra*, and fitting her as a coaling depôt. This, it is understood, is in consequence of the expeditious manner in which the ex-Indian troopship *Jumna* was similarly fitted at this yard. The *Alexandra* is a vessel of over 9,000 tons, and was built nearly thirty years ago. She is now lying in the East Kyle of Bute, with a number of other obsolete vessels. Before being sent there, she was lying in reserve at this port for several years. The *Exe*, of the Second Destroyer Flotilla, has arrived from Portland to have her defects made good; her under-water fittings are to be examined, and her bottom coated with a preservative composition. The *Greyhound*, *Racehorse*, and *Roebuck*, of the Third Destroyer Flotilla, also arrived from Devonport, and they have since been refitted. These vessels, it may be remembered, have carried out periodical trials for the past two years to test the effect of different kinds of compositions with which their bottoms have been coated, and they will shortly carry out further trials. The destroyer *Erne*, of our Reserve Flotilla, has also been docked for a refit. Two destroyers of the Second Flotilla, the *Lively* and *Nith*, have been in dockyard hands owing to damages sustained during the manœuvres. The *Nith* has left to rejoin the flotilla which has been cruising in the Irish Sea; the *Lively* is still under repair, she having been docked for underwater examination. The *Orwell*, of the Second Destroyer Flotilla, which has been on duty at Lundy Island, arrived, and has since been docked for her boilers to be retubed. Her place in the flotilla has been taken by the *Panther*, of the Reserve Division. Other work done or in hand includes repairs to the War Department steamer *Bison*, the fitting out of the old corvette *Dido* (now *Actaeon II.*) for service as tender to the torpedo-school ship, and the conversion of the sloop *Merlin* into a surveying ship. The latter vessel is now almost completed, and is to be commissioned on September 4th for service in China. When she is done, her sister vessel, the *Fantome*, will be commenced. The destroyer *Contest* was undocked on August 20th, and shortly leaves to join the Devonport Reserve Division. The cruiser *Blenheim* is to be attached to the torpedo craft flotilla, and will, therefore, be placed under the orders of Rear-Admiral Winsloe. A test mobilisation of the scouts and torpedo craft took place on August 17th, and was very smartly carried out. Most of the vessels were at Chatham. Another of the cruisers of the Reserve Division, the *Talbot*, proceeds to Devonport in a fortnight's time, with a new crew for the *Minerva*, and I understand she will afterwards join the Reserve Division at that port. I am told that the idea of transferring the Gunnery School to Chatham, which has been on the *tapis* for about eight years, has been finally abandoned.

Dockyard Re-organisation.

From time to time our correspondents at the various dockyards have reported the changes which have taken place, or have been proposed, with regard to the position of the workmen and other matters. At the beginning of the month there was issued in the form of a Parliamentary paper a memorandum which explained in detail the changes which have been carried out and those suggested in the administration of the home dockyards. The memorandum states that, as was promised in the House of Commons on March 1st last, the Board of Admiralty have inspected all the yards and interviewed representatives of the different classes of workmen employed therein. As a result, it has been decided that there is need for some revision in regard to the scale of pay for certain classes of workmen, and some alterations in this respect are to be made. The conditions under which the men serve will be greatly improved, and the rates of pay will be adjusted, and the working hours revised. The revised hours of labour commenced last month, and October 1st is the date mentioned when it is

hoped the other changes will come into operation. It is estimated that the amount of the additional expenditure will be about £60,000 a year. In the interviews with the workmen, several grievances were brought to the attention of the Board, and all of these were most carefully considered. Many of the grievances have already been remedied, while the others are still under discussion. Among the improvements suggested was the experimental adoption of a premium system at Portsmouth, Devonport, Chatham, and Sheerness, and the men, as has previously been stated in these columns, are to be encouraged to suggest improvements in the various methods in vogue and in the tools used. So, altogether, the conditions of service in the dockyards will be considerably improved before long.

Devonport Dockyard.

We have thought all along that our new vessel would be another "Dreadnought," and we were, therefore, not surprised to hear that such is to be the case. The vessel will not, I understand, be laid down until February, and Mr. Thoms, foreman of the yard, has been selected to supervise her construction. Of course, we shall not be able to show what we can do in the way of record shipbuilding, as Portsmouth has done, but it will be interesting to see what we can do in friendly rivalry with that yard, as we both have a similar vessel to build. When the *Montagu* went ashore I told you that many here were dubious as to ever seeing the vessel afloat again, and their prognostications have, unfortunately, come true. It is greatly to be regretted, for, apart from the loss she is to the Navy, she would have provided a large amount of work to get her ready for sea again, and it is not likely that an additional vessel to take her place will be laid down by the present economical Government. A well-known warrant officer (Chief Gunner Brockman), who has been serving in the torpedo-school ship *Defiance* for the past four years, has just been promoted to a commission as lieutenant. Although handicapped by the loss of his left foot by an accident whilst serving in the *Magnificent*, some years ago, this in no way interfered with the performance of his duties, and all who know Mr. Brockman will congratulate him upon his well-deserved promotion, and also upon his re-appointment to his post in the *Defiance* for the inspection of stores. The battleship *Royal Sovereign* was placed in the new tidal basin at the extension works on August 2nd; she is the first ship to occupy the basin, the entrance to which has been deepened since this portion of the work was reported as completed some months ago. The destroyer *Leopard*, which sustained some damage on the morning of August 7th, through striking a buoy in the Hamoaze, had to be run aground. It was afterwards found that a hole had been made in her below the water-line, so temporary repairs were effected, and she was brought into dock. In trying to avoid the buoy, the *Leopard* struck the *Kennet's* rudder, which was considerably damaged. The *Hibernia* was docked in No. 5 Dock of Keyham Extension Works on August 10th, and this event practically marked the completion of the work which was commenced ten years ago. It was thought that there might be some ceremony to mark the conclusion of such a colossal undertaking; but nothing out of the ordinary occurred. It is stated that the *Hibernia* is to take the place of the *Montagu* in the Channel Fleet, and she is expected to leave for her gun and steam trials on September 30th. Our other vessel, the *Minotaur*, is making good progress; the whole of her water-tube boilers have been shipped, as have also several of the cylindrical gun supports. The test mobilisation of the torpedo craft on August 17th was a complete success, and the orders were carried out without a hitch. The scout *Skirmisher*, with the torpedo craft flotilla went to sea for a week's cruise on August 27th. The battleship *Hannibal*, which has been in dockyard hands for some time, was undocked on the 23rd, and will probably soon be ready to join the Reserve Division. The cruiser *Isis* was docked in No. 3 Dock the same day. The cruiser *Argyll* is being overhauled. Her bottom was found to be pitted in several places, and her speed has not been satisfactory. The propeller shafting is to be taken out, and the bearings closely examined. She will be undocked on September 10th. Mr. Richards, the new manager of the Constructive Department, took up his duties on the 2nd. Of forthcoming arrangements that I know of, the ships of the Reserve Division are to leave for their quarterly cruise on September 10th, and the following day the *Minerva* is due here from the Mediterranean to re-commission. Her new crew will be brought round from Sheerness in the *Talbot*, and that vessel will afterwards join the Reserve Division at this port.

Keyham Extension.

The entry of the *Hibernia* into No. 5 Dock at Keyham Extension Works marked an important development in our naval resources, and Devonport now possesses docking accommodation for the largest ships in the Navy. It will, therefore, be no longer necessary to send vessels built there to Portsmouth to be docked, as was done in the case of the *Hibernia's* sister ship, the *King Edward VII.* The scheme has already involved the expenditure of about three and a half millions sterling, and the provision of factories, workshops, and general equipment will increase the outlay to between five and six millions. The work was commenced without ceremony in February, 1896, and, although it was ten years in progress, and cost such a large amount, no ceremony marked its completion. When the work was in full swing almost four thousand men were employed, and there are now about a thousand engaged in carrying out the extension of one of the docks which was originally 470 ft. long, and which is being lengthened 200 ft. The other two docks are respectively 745 ft. and 741 ft. long between the caissons. The extension abuts on the Hamoaze, and adjoins on the north the old Keyham Dockyard; it covers a space of about 120 acres. The chief features are a tidal basin, a closed basin, the three docks, and an entrance lock. The area of the tidal basin is ten acres, with a depth of 55 ft., and quayage extending for 2,100 ft., and in this could be berthed all the battleships of the "King Edward" class. The closed basin covers 35½ acres, has a depth of 55½ ft., and a quay front of about 5,000 ft. The entrance lock, through which the vessels will pass from the Hamoaze into the closed basin, is 730 ft. long, and can, on an emergency, be used as a dock. The docks are 48 ft. deep, and for pumping out the graving docks duplicate sets of main pumps of the centrifugal type, each capable of lifting 15,000 tons of water an hour, have been erected. Of the difficulties which the contractors, Sir John Jackson, Ltd., have had to encounter from time to time our readers are doubtless aware. The recapitulation of them would fill a fair-sized volume, which would form interesting reading.

Pembroke Dockyard.

The one thing in Mr. Robertson's statement of especial interest to Pembroke was that part in which he stated that a "mother" ship for destroyers was believed to be necessary, and that such a ship, if decided upon, would be probably built at Pembroke. With reference to this, at the quarterly meeting of the Pembroke County Council, at the beginning of the month, a letter from the Prime Minister was read. The letter was in reply to a statement which had been forwarded to the Prime Minister by the Council with reference to the future of the yard, and stated that Lord Tweedmouth had been much distressed at the difficulties which lay in the way of the maintenance of the yard at its full strength, and went on to say: "The reduction in the number of ships laid down, and their enormous size, had made it less possible even than before to allot ships under construction among the various building yards, but, after long and anxious consideration, Lord Tweedmouth was glad to say it had been found possible to assign a new ship of moderate size to be built at Pembroke, and provision had been made for her in the naval programme. No such serious steps, therefore, as the closing of the yard need be contemplated in the near future." We should have thought a lot more of the letter if it had said that the reports of the closing of the yard could be absolutely dismissed as fictions. The figures I gave you last month are said to be without official authority. But I shall be very much surprised if they do not prove to be somewhere near the mark. "It's an ill wind that blows nobody good," and the stranding of the *Montagu* was, as it were, a godsend to us here, the preparation of appliances for use in the salvage operations having given us plenty of work. The men, too, whom we have sent to Lundy Island are the cause of the work we have in hand being "hung out" a little longer than it would otherwise have been. The abandonment of the salvage operations occasioned no surprise in fact, it was expected to be announced some time before. Messrs. Scott & Co., the machinery contractors for the *Defence*, are making good progress with that vessel, and at the end of last month four gangs of shipwrights were transferred from her to the

Warrior, so as to expedite that vessel for her steam trials, which are expected to take place at the end of September. The distilling vessel *Aquarius* was docked on the 17th, the work being carried out by dockyard hands, as the crew, with the exception of a few of the chief officers, had been paid off two days previously. The old crew, all told, numbered forty three, but it is now proposed to provide her with accommodation for eighty if she is fitted up as a fleet workshop. The job, however, is by no means a certainty, as only drawings and an estimate of cost are to be prepared at present. The authorities are only going to spend a limited amount, and if the estimate exceeds this another vessel will probably be provided. If so, nothing will be done to the *Aquarius* beyond painting her bottom. The tug *Alligator* and a chargeman of shipwrights and sixteen men were sent to Lundy on the 15th, to salve a barge which sank a couple of months ago, with six of the 6 in. guns of the *Montagu*. The work was successfully accomplished, and the guns and barge brought here.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from July 25th, to August 22nd, 1906:—

Engineer-Commanders.—W. D. Chope, to the *Victory*, for oil and fuel course, to date August 7th; J. M. Downer, to the *Amphitrite*, to date July 24th; E. G. Guyatt, to the *Victory*, for oil and fuel course, to date August 7th; S. G. Haddock, to the *Victory*, for oil and fuel course, to date August 7th; C. A. Moore, has been placed on the retired list, to date August 9th; J. H. Pill, to the *Revenge*, to date August 16th; J. T. Purkis, to the *Hawke*, on re-commissioning, to date August 8th; H. J. Walker, to the *Victory*, additional, for supervision of instruction of engine-room ratings in large water-tube boilers, to date July 24th; W. Wright, to the *Proserpine*, on re-commissioning, undated.

Engineer-Lieutenants.—E. F. Baker to the *Argyll*, as acting interpreter, in German, to date August 13th; W. W. Bills, has been advanced to the Senior List, to date August 16th; J. F. Bushby to the *Hecla*, for the *Vigilant*, to date July 28th; A. J. Butler, to the *Foresight*, to date July 28th; L. W. Cargenven, to the *Blenheim*, to date August 16th; W. A. Donovan, to the *Niobe*, to date August 3rd; J. W. Figgins, to the *Victory*, for the *Spiteful*, to date July 28th; W. H. Ham, to the *Spartiate*, to date August 2nd; G. J. Hamilton, to the *Defiance*, to date August 3rd; P. G. Harris, to the *Vivid*, additional, to be detailed for the *Minotaur*, to date August 3rd; J. E. Haves, to the *Pandora*, on recommissioning, to date August 28th; J. B. Hewitt, to the *Adventure*, to date August 20th; A. E. Hyne, to the *President*, additional, for service in Controller's Department (temporary) to date August 3rd; G. H. Jeffery, to the *Cormorant*, additional, for torpedo submarine depôt, to date August 7th; C. J. Limpenny, to the *Victory*, for oil and fuel course, to date August 7th; F. H. Lyon, to the *Lancaster*, to date August 16th; W. H. S. Moysey, to the *Victory*, for oil and fuel course, to date August 7th; W. H. S. Moysey, to the *Speedwell*, to date August 13th; J. M. J. Murphy, to the *Hecla*, for the *Kestrel*, to date August 2nd; C. L. J. Risch, to the *Proserpine*, additional, to date August 28th and on recommissioning, undated; Ivor E. S. Roberts, to the *President*, additional, for service in the Controller's Department to date September 1st; W. Rowe, to the *Racer*, additional, for Osborne College, to date September 1st; J. W. J. Sellex, to the *Magnificent*, to date August 3rd; P. J. Shrubsole, to the *Victorious* to date August 3rd; E. C. Smith, to the *Sapphire*, additional, for the *Orwell* to date August 7th; J. Wisdom, to the *Hawke* on recommissioning, to date August 8th; A. O. Wood, to the *Bulwark*, to date August 8th.

Engineer Sub-Lieutenants.—R. C. Brown to the *Black Prince*, additional, for training, to date August 16th; G. Cock, to the *Cornwallis*, additional, for training, to date July 26th; S. W. Cooke, to the *Pembroke*, for the *Africa*, to date July 31st; S. H. Dunlop, to the *Ocean*, additional, for training, to date July 26th; R. C. Grigg, to the *Prince George*, additional, for training, to date July 26th; H. G. W. Haddy, to the *Victory*, for oil and fuel course, to date August 7th; H. M. Hayward, to the *Exmouth*, additional, for training, to date July 26th; G. Hick, to the *Glory*, additional, for training, to date July 26th; W. C. Horton, to the *Dominion* additional, for training, to date August 16th; E. Iliff, to the *Euryalus*, additional, for training to date July 26th; C. W. Keates, to the *Hindustan*, additional, for training to date August 16th; G. E. W. McEwen, to the *King Edward VII.*, additional, for training, to date August 16th; F. L. Mogg, to the *Hogue*, additional, for training, to date July 26th; J. G. Parry, to the *Sutlej*, additional, for training, to date July 26th; J. Pattinson, to the *Goliath*, additional, for training to date July 26th; W. H. Pudner, to the *New Zealand*, additional, for training, to date August 16th; H. J. Rampling, to the *Swiftsure*, additional, for training, to date July 26th; H. W. Smith, to the *Canopus*, additional, for training, to date July 26th; L. H. Smith, to the *Russell*, additional, for training, to date July 26th; G. H. Turrall, to the *Berwick*, additional, for training, to date August 16th; E. C. Warden, to the *Victorious*, additional, for training, to date August 16th; W. Waters, to the *Duke of Edinburgh*, additional, for training, to date August 16th; S. G. Wheeler, to the *Commonwealth*, additional, for training, to date August 16th.

Engineer-Cadets.—P. W. Allen, R. C. Boddie, F. Gough Brown, R. H. M. Bury, W. A. Carlisle, C. B. Evington, V. O. Foreman, W. H. F. Hudson, R. Myddelton Jones, W. B. Kennaway, P. King, V. D. Nops, A. H. Parry, E. Mc. K. Phillips, F. H. Pratt, C. H. J. Purkis, W. G. Radmore, E. G. Sanders, T. Spalding, J. D. Sturrock, L. Thackara, E. Williamson and A. C. Wippell appointed to be Engineer Sub-Lieutenants and appointed to the *Vivid*, all to date August 1st.

Artificer Engineers.—F. W. Beck, to the *Victory*, additional, for the, *Firefly* at the works of Messrs. White, Cowes, to date August 13th; A. W. P. Boss, to the *Vivid*, additional, to be detailed for the *Cyclops*; and to assist on the staff of the Admiral Superintendent Tyne and Thames district, to date August 11th.

Royal Naval Reserve.

Senior Engineers.—J. Barber, W. Birkett, J. Cameron, W. Mc. Keand, H. C. Small, have been placed on the Retired List.

Engineers.—F. Harrison has been placed on the retired list with permission to assume the rank of Chief Engineer, H. G. Hean, J. Purvis, R. T. Rule, R. Vincent have been placed on the Retired List.

Assistant Engineer.—W. Relph to be Engineer.

THE SCREW PROPELLER.

II.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., &c.

IN the early part of 1838 a ship was designed for this purpose by Mr. Pascoe, of 237 tons burthen. She was 106 ft. 8 in. long between perpendiculars, and 125 ft. overall; 21 ft. 10 in. extreme breadth, and depth of hold 13 ft.; her draught of water loaded was 10 ft. aft and forward 9 ft.. She was propelled by two engines of 90 H.P. collective, having two cylinders 37 in. in diameter and 3-ft. stroke, and it was expected that her speed with them would be 5 knots per hour. She was named *Archimedes*, and launched on October 18th, 1838, but did not make her trials till the spring of 1839, having had a mishap with her boiler. In the early part of that year a company had been formed, called the "Ship Propeller Company," consisting of Mr. Smith and his friends, and supporters. They obtained an Act of Parliament for the formation of this company in July of that year, and finally purchased Smith's patents and took over the contract for the construction of the *Archimedes* and all connected with the experiments. This ship was originally fitted with a screw, having only one convolution, or a single thread, and fixed in a recess in the deadwood. It

*For previous articles, see issues March 16th, 30th, May 4th, 25th, June 8th, 22nd, July 6th, and August 1st.

was soon found, however, that this propeller produced considerable vibration, as was to be expected. The trials were made first of all in smooth water on the Thames, and the mean speed as ascertained by runs over the measured mile in Long Reach was found to be 9·64 miles per hour. It is interesting to note in passing that the cost of the *Archimedes* was about £10,500. In the month of May, 1839, she proceeded to sea and made the trip from Gravesend to Portsmouth in twenty hours, the weather throughout being bad. At the latter port she was taken in hand by some of the naval officers of the dockyard, who tried her against H.M.S. *Vulcan*, then one of the fastest vessels in the Navy, with a result that gave complete saisfaction, and established the belief in the efficiency of the screw as a propeller. Trouble, however, was experienced with the boilers, and after these trials had taken place, new ones were ordered, and, six months after, were on board and the vessel again on service, this time making a voyage to the Texel; but before its completion the crankshaft broke, which necessitated her returning to the Thames, and once more being placed in the hands of the engineers to repair. The opportunity was taken to replace the original propeller with one having two convolutions, that is to say, it was a double-thread screw. It may be mentioned, however, that the convolutions in this case were not complete, they were, in fact, only half a turn; but the screw was now properly balanced, so that in this and in other ways were the means provided of giving results superior to those previously obtained. In the spring of 1840 the *Archimedes* was employed in running a series of trials against the Calais-Dover mail packets, with results, on the whole, very satisfactory to her designers, and which are given on the following tables:—

"Archimedes" and her Competitors in the Channel Trials.

Name of Ship.	Propeller.	Tonnage. B.M.	Dimensions.	Area of Mid Section.	Engines N.H.P.	N.H.P. Mid Sec.	Speed on trial.	Cylinders.
			Ft. Ft.	Sq. Ft.				
Ariel	Paddle	152	108 long 17·3 beam	95·0	60	0·632	10·4	—
Beaver ...	,,	128	102·2 ,, 16·0 ,,	84·0	62	0·738	11·2	—
Swallow ...	,,	133	107·6 ,, 14·8 ,,	84·0	70	0·833	10·4	—
Widgeon ...	,,	162	108·0 ,, 17·1 ,,	95·0	90	0·947	10·3	Two 39 in. diam. × 37 in.
Archimedes ...	Screw	237	106·0 ,, 21·8 ,,	143·0	80	0·559	9·6	Two 37 in. ,, × 36 in.

Results of Trials of "Archimedes" at Dover, 1840.

Name of Competitor.	Course.	Weather.	Conditions.	Speed of Archimedes.	Winner by Time.
				Knots.	
1. Ariel	Dover to Calais	Fair	Both using Sails	9·75	Archimedes by 6 minutes.
2. Do.	Calais to Dover	Do.	Do.	9·75	,, 5 ,,
3. Beaver	Dover to Ostend	Do.	—	9·50	,, 4 ,,
4. Do.	Ostend to Dover	Do.	—	9·25	Beaver by 9 minutes.
5. Swallow	To Calais & Back	Do.	Steam only	—	Archimedes.
6. Widgeon	19-Mile Course	Fine, Fair Wind	Do.	8·50	Widgeon by 6 minutes.
7. Do.	Do.	Head Wind	Do.	8·00	,, 10 ,,
8. Do.	Do.	No Wind	Quite Smooth	—	,, 3½ ,,
9. Do.	Do.	Fresh Breeze	Both using Sails	—	Archimedes by 9 minutes.

Quickest passage from Dover to Calais was made by the *Archimedes*, and took one hour fifty-three and a-half minutes to perform.

After the Channel trials she was handed over to the care of Captain Chappell, R.N., who took her round the whole of Great Britain to exhibit her to all concerned in steam navigation. He then took her to Oporto, making the voyage from London in sixty-eight and a-half hours, and thereby breaking the record of time to that port. She was then, later on, lent to Mr. Brunel, to experiment with at Bristol, in order that he might find out the best form of screw for the *Great Britain*. As an immediate result of the visit of the *Archimedes* to the British ports, four screw steamers were built in 1840-1, namely, ss. *Princess Royal* at Newcastle, ss. *Margaret* and ss. *Senator* at Hull, and the *Great Northern* at Londonderry. This latter vessel was quite a large one, in fact, for that time a very large one, namely, 1,500 tons burthen.

In 1841 the first screw vessel for the Navy was laid down at Sheerness, and was 176 ft. 6 in. long, 32 ft. 8½ in. beam, 880 tons B.M., and 200 N.H.P. She was launched in the spring of 1843, and named *Rattler*, and at first fitted with a screw exactly similar to the last one supplied to the *Archimedes*, that is to say, it was a double-threaded one, each thread being half a convolution, and was 9 ft. in diameter, 11 ft. pitch, and 5 ft. 6 in. long. Subsequently the length of the screw was very much reduced, and finally it was found that the best results of this ship were obtained, and the usual length was only 1-6th of a convolution. In fact, from 1843-5 many experiments were made on the *Rattler*, with the object of finding out the form of screw which gave the fastest speed. At any rate, when it had been found which gave the best result, the Admiralty ordered twenty vessels to be fitted with similar screws; these orders, and the above-named mercantile ones, may be taken as the first results of the excellent and expensive experiments carried out so pluckily and tenaciously by Francis Pettit Smith, the banker Wright, and his other associates.

The *Archimedes* herself, after laying up in London Docks for some time, was offered for sale, and it was estimated that at that time her owners had spent upwards of £50,000 on her and her trials, and all they then had to show for it was this half-worn little steamer. It is ever to be regretted that neither Mr. Smith, Mr. Wright the banker, nor his other friends, received any adequate reward for their enterprise, and certainly no mark of the approbation they were justly entitled to at the hands of those who usually represent the public on such occasions, whereas, had these gentlemen contributed a quarter of that sum to the party funds, their names would not have been handed down to posterity as they are now, without a useful handle attached, so often held by less deserving men.

Notwithstanding, however, the success of these trials, no attempt was made, or, at least, if made, none resulted in placing a screw steamer on service across the Straits of Dover, and it was not until 1878, when, at the sugg stion of the author, the South Eastern Railway had constructed

a twin-screw steamer, named the *Folkestone*, for second-class passengers and cargo service, that a screw boat again competed with the paddle. An order soon followed for two more steamers of the same kind, as it was found that the *Folkestone* could make a fairly good passage across the Channel in weather which the paddle boats could not face. The ss. *Folkestone* was 190 ft. long, 25 ft beam, and 11 ft. 7 in. depth of hold; her displacement at 8 ft. draught of water was 611 tons, and at this she steamed 13 knots with 650 H.P. She was capable of being loaded to 10 ft. draught, when the cargo was 356 tons. On the one occasion that the *Archimedes* performed the journey from Dover to Calais in one hour fifty-three and a-half minutes, and thereby beating all previous records, the mean speed was over 11 knots. The speed of the *Folkestone* and her sister-ships was, as has been already stated, 13 knots. But in spite of their success, screw steamers were not adopted for the cross-Channel service until quite recently, when the speed of the turbine ships with three screw propellers had been assured by service elsewhere, induced the railway companies to try them on this route.

It is interesting to observe in passing how very small were the steamers engaged in the various trades less than seventy years ago. It has been seen that those performing the Channel service between Dover and Calais were even smaller than the *Archimedes*. A glance at the following table will impress one with the fact that the ships then carrying on the service on the Atlantic between New York and Liverpool were hardly larger than those now doing duty at Dover and not much larger than the Channel boat of a quarter of a century ago, as the following examples prove:—

Comparison of Old with Modern Steamers.

Name.	Date.	Dimensions.	Tonnage. Reg.	Tonnage. Dis.	Cylinders.	Speed	Service.
Great Western	1837	212 by 35·3 by 23 ft.	1321	2100	Two 73 in. by 84 in.	10·0	Atlantic.
Widgeon	1839	108 by 17·8 by ft.	162	205	Two 39 in. by 37 in.	10·3	Dover-Calais.
Invicta	1882	312 by 33·6 by 16 ft.	1236	1750	Two 80 in. by 78 in.	17·5	Ditto.
Queen	1904	310 by 40 by 25 ft.	1676	2000	Three turbines	21·7	Ditto.

Particulars of the Five Largest Steamers in Existence in 1839, when ss. "Archimedes" was Tried.

Dimensions.	Great Western.	Liverpool.	British Queen.	President.	United Kingdom.
Length, under deck	212·0	216·0	245·0	238·0	206·0
Beam, ex paddle boxes	35·33	30·83	40·0	41·0	36·5
Depth of Hold, amidships	23·17	19 67	27·5	23·5	22·0
Total Tonnage	1321	1140·5	2016	1840	1400
Nominal Horse Power	450	468	500	540	450
Diameter of Cylinders ... . inches	73·0	75·0	77·5	80·0	73·0
Stroke of Piston ... ... feet	7·0	7·0	7·0	7·5	7·0
Diameter of Paddle Wheels	28·75	28·42	30·5	31 0	28·0
Weight of Machinery, total, including water... .. tons	480	450	500	500	450
Weight, 20 days' coal	600	600	750	750	600
Ditto Cargo	250	200	500	750	—
Ditto Coal and Cargo	850	800	1250	1500	...
Draught Water, with above	16·0	16·5	16·6	17·0	

MOSELEY'S DURIFLEX PACKING.

THE Britisher's love of fair play is one of the characteristics of the race which is acknowledged all the world over, and we hope that such characteristic will long continue to be in evidence. It is in this spirit we desire to refer to a matter which is particularly interesting to sea-going engineers, viz., the importance of using a really first-class packing, and those who have used the Duriflex packing, manufactured by Messrs. David Moseley & Sons, Limited, of Manchester, are well aware of, and duly appreciate, the excellent properties of that article. It is a matter of great regret that we learn from the manufacturers of this packing that certain individuals have been offering in the market, and in some cases have supplied, a cheap imitation in place of the genuine article, and we think that it is only fair that purchasers of this, or any other speciality of which they have knowledge or believe in, should be aware of these matters, so that they may take proper care to deal with reliable marine store dealers who make it their business to only sell correctly marked goods. In order to put a stop to these fraudulent transactions we understand that the manufacturers are prepared to offer a handsome reward to any person who will assist them to gain this end, and it may be well to point out that it is necessary that all purchasers of the packing should see that it is stamped, every 2 ft. of its length, with the firm's well-known trade mark, and the words, "Moseley's Duriflex Patent Packing." In bringing this matter to the notice of our readers we feel that we are not only carrying out a duty to the manufacturers in particular, but one to the public in general.

Liste Navale Francaise. Toulon: J. Alté.

This list makes its customary appearance for July, and, as we have previously remarked in these pages, the arrangement and style are altogether different in the British Navy Lists, in that it seems to act in somewhat of a teaching capacity. We have, for instance, an epitome of all orders and decrees affecting the Navy that have been issued in the interval since the last publication. Then, again, there are reviews of current literature connected with the Services likely to be of use to naval officers. This includes the contents of journals such as our own and those issued by scientific societies. We have also an account of the British Navy manœuvres, very complete, and extracted mainly from the *Times*. Next the new constructions that are being built in the principal countries are found here. Following there is a list of promotions in the fleet and the reasons stated where these are special.

The ordinary alphabetical list of officers is then given with the names of the fleet arranged in the same way. Comencing with the Ministry of Marine and Administration, we have officials named according to rank and where employed, with other details concerning them. The particulars concerning the fleet are on different coloured paper to readily distinguish them, and included we find vessels built, building, and condemned. Active-service ships are arranged in squadrons, each with its officers. All the minor departments connected even remotely with the Navy are found here also.

CORRESPONDENCE.

[We do not hold ourselves responsible for the opinions of our correspondents.]

The Recent Accident to the "Deutschland" and the Emigrant Ship "Sirio" Disaster.

[To the Editor of the MARINE ENGINEER.*]*

DEAR SIR,—In reply to questions asked of us from many different quarters, we are in a position to state that at the moment of the accident at Dover to the Imperial Mail ss. *Deutschland*, the whole of her bulkhead doors were simultaneously closed by the "Stone-Lloyd" system, so that if the accident had been ten times as serious as it was, the vessel would still have been perfectly safe, and there would not have been the slightest danger of her sinking.

In the case of the emigrant ship *Sirio* disaster, unfortunately she was not rendered unsinkable by being fitted with the "Stone-Lloyd" system, and had it not been for the near neighbourhood of other vessels, the loss of life would have been even more appalling than it was.

Considering that at the cost of about 1 per cent. of her cost any vessel could be rendered practically unsinkable, and the interest on this extra cost should be repaid over and over again by the reduction in insurance, to say nothing of other obvious advantages, surely it is not too much to expect that shipowners—passenger shipowners, at any rate—will no longer hesitate to adopt this invention, which has been proved to be an absolutely reliable and unqualified success.—We are, dear sir, yours faithfully,

Deptford, S.E. J. STONE & COMPANY, LTD.
August 15th, 1906. (Panizzi Preston, Director.)

LAUNCH OF A CANADIAN ICE-BREAKER AT BARROW.

VICKERS, SONS & MAXIM launched from their naval construction yard at Barrow-in-Furness, on August 21st, an ice-breaking and surveying steamer, built to the order of the Canadian Government, and named the *Lady Grey*. The christening ceremony was performed by Mrs. O'Grady Haly. The object of the new steamer is to break ice in the River St. Lawrence, with the view of keeping it open in the winter season for navigation. The steamer will also be used by the Marine and Fisheries Board during the times she is not employed in her primary work in surveying the coasts and channels in navigable waters. She will also serve for salvage work, and for this purpose powerful pumps have been provided. Further, she is fitted, when required, to act as a tug, and, having great engine power, will be very useful in this capacity. Her dimensions are: length (between perpendiculars), 172 ft.; breadth (moulded), 32 ft.; depth (moulded), 18 ft.; draft (normal), 12 ft.; displacement, 1,055 tons; speed, 14 knots. The hull is naturally built of great strength, so as to resist impact with the ice-floes. She is built to Board of Trade requirements, and to the conditions of the Canadian Steamboat Inspection Act. The bow is powerful and strong, and is built up for mounting and breaking through green ice, and smashing up pack or solid ice. For this purpose, a broad belt is fitted fore and aft, extending in depth considerably above and below the water-line, and the gross sectional form of the boat is such as to resist the lateral pressure which might otherwise close in and nip the hull. With the view of further strengthening the vessel to withstand thwartship pressure, double framing has been fitted by the introduction of intermediate channels. Forward, where the vessel first strikes the ice, these additional members extend from the keel to the main deck, while, aft, they are introduced between the bilge and main deck. The side plating is also increased in thickness from the stern to a point well aft of midships. The hull is divided into six water-tight compartments, and a double bottom extends from the forward to the after peak bulkheads. The compartments forward and aft of these bulkheads are arranged as deep ballast tanks, into or from which water can be pumped to quickly alter the trim to assist the vessel in riding over the ice where, by reason of the superposed weight, the ice is broken. These tanks can be rapidly emptied from one into the other. The boat is fitted with large rudder and proportionately powerful hand and steam steering gear. The portion of the rudder-head at and above water level is protected by a heavy casting, and the gear is made strong enough to withstand excessive pressure when working among ice. Special cabins are provided, and provision has been introduced to avoid freezing. An electric lighting installation will be fitted, and a 16,000-candlelight searchlight will be fitted. The propelling power embraces two sets of inverted vertical direct-acting triple-expansion surface-condensing engines, working on cranks placed at 120 degrees with each other, the sequence being high, low, and intermediate when going ahead. The engines, at 130 revolutions per minute, are capable of developing collectively 2,300 I.H.P. The diameter of the high-pressure cylinders is 19 in., the intermediate 30 in., and the two low-pressure cylinders, 49 in., with a stroke of 27 in. Cast-iron liners are fitted only on the high-pressure cylinders, and the brick type for the intermediate cylinders, and of the double-ported flat form for the low-pressure cylinder, and each is actuated by valve gear of the double eccentric link motion, with reversing gear of the direct-acting steam and hydraulic description. Any of the condensing pumps can circulate through any or both condensers. It has been thought necessary to supply the *Lady Grey* with two sets of propellers, for ordinary summer use and for ice-work. Both sets of propellers are of the built-up type, with three blades. Steam is supplied at a working pressure of 180 lb. per square inch by four single-ended cylindrical boilers, 12 ft. 9 in. in diameter, and 10 ft. 6 in. long. Jones's under-feed mechanical stoker system, with fan for air supply, will be fitted in Canada. In the stokehold there is a Lee's ash-ejector fitted for discharging ashes overboard, in addition to two hand ash-hoists. The *Lady Grey* is a somewhat experimental steamer. It is evident, if she is found to be of utility, a fleet of these craft will be needed to keep the St. Lawrence free from ice in the winter months, and to enable a navigable channel to be maintained from the sea to Montreal and Quebec, and the growing importance of Canadian trade renders it necessary that something of this sort shall be done, and means will be found to do it, even if it is necessary to augment this initial contribution to the ice-breaking fleet owned by the Canadian Government.

ENGINEERING AND MACHINERY EXHIBITION.

THE above exhibition, to be held at Olympia from September 15th to October 17th inclusive, promises to be, from the number of important firms exhibiting, a thoroughly representative one. It is under the patronage of those who are directly interested in promoting the success of the engineering industry as a whole, and the hon. advisory committee comprises the leading men connected with all branches of the engineering industry.

Colonial and foreign Governments, and the representatives of large engineering works and undertakings are being specially invited to inspect the exhibition, and to increase the interest in many of the exhibits, lectures, conferences, &c., are being arranged. On Saturday, September 29th, the Institute of Marine Engineers has arranged to pay it a visit, when papers will be read by the Hon. C. A. Parsons, M.A., C.B., and Mr. Walker on "Steam Turbines," and Mr. A. E. Battle on "Sanitary Science as Applied to Marine Engineering."

Special arrangements are being made to encourage engineering students to visit the exhibition, and to afford them the opportunity of acquiring practical knowledge, and of receiving technical instruction in an intelligent, and at the same time interesting, manner. The Institute of Marine Engineers is offering a prize to the graduate (apprentice) who writes the best essay on a visit to the exhibition, not necessarily on the date named for the official visit, but on any day while the exhibition is open.

From the point of view of the user, the exhibition should be of inestimable benefit and interest, as it will afford him an opportunity, not otherwise possible, of seeing in motion such classes of machinery and appliances as may be suited to his requirements, and of inspecting under one large roof the different types of machinery likely to suit him.

THE IRISH INTERNATIONAL EXHIBITION.

AN event, which may be relied upon to give great impetus to the development of Irish trade, and from which lasting benefits should result, is to take place in Dublin in 1907. May of that year will see the opening of the Irish International Exhibition, conceived on a scale never hitherto attempted, and the first Exhibition of its kind held in Ireland for nearly forty years.

The chief objects of the Exhibition are, "to promote and foster the Industries, Arts, and Science of Ireland by a display of the products for which the country is famous, and to stimulate commercial development in all its branches."

The manufactures and trades of Ireland have, in the past, suffered from a series of repressions, proceeding from various causes; but now that these have been removed, and progress is not only possible, but essential, the necessity arises for bringing out all that is best in Irish trade, and not only raising the existing commercial status of the community, but still further developing those industries for the conduct of which the country possesses great and natural advantages

The primary object of the Exhibition being the promotion of the trade, it is confidently hoped that manufacturers and others will give it their fullest support, and that every advantage will be taken of the exceptional opportunities afforded for opening up and extending commercial relations with all parts of the world.

Not only should the staple industries of the country be materially assisted, but every branch of manufacture being represented, and the products of all nations, both in the raw and finished state, being brought together, the effect on trade generally should be far-reaching and beneficial.

That great and widespread interest in the event has been roused is evidenced by the many offers of substantial support already received from Great Britain, the Colonies, India, America, and the Continent of Europe, from which countries varied and valuable exhibits are expected.

In addition to Industries, Arts and Science, great prominence will be given to the History, Literature, and Antiquities of Ireland, while a special feature, and one which will assuredly receive cordial support, will be the Cottage Industries and Women's Industrial Section, for which particular arrangements are being made, and the fostering of which means so much to the peasants of Ireland. Spinning and weaving and lace-making form the principal occupations of the peasant women; and it is hoped that the Exhibition will do much towards improving and increasing this industry.

The Exhibition grounds are excellently situated and admirably adapted to the purpose. They will cover about fifty-two acres, including Herbert Park, recently made over to the public by the Earl of Pembroke.

The Port of Dublin, being in direct communication with English and Scotch shipping centres, affords great facilities for the import of exhibits, to ensure the safety of which, while in the Exhibition, every precaution will be taken.

The entire organisation is under the presidency of the Most Honourable the Marquis of Ormonde, K.P., a gentleman known to be keenly interested in the forward movement of Irish Industries, whilst an influential list of Vice-Presidents and Committee argues strongly that nothing will be omitted in the general endeavour to ensure the success of the Exhibition.

TRIAL TRIP OF H.M. CRUISER "NATAL."

THE armoured cruiser *Natal*, the latest of many warships built for the British Navy by Messrs. Vickers, Sons & Maxim, Ltd., at their naval construction works, Barrow-in-Furness, went through her trials in the early part of August, including a series of searching tests to determine her speed, radius of action, and manœuvring capabilities. These tests, which are specified by the Admiralty, require that the propelling machinery of all ships shall be run for thirty hours at one-fifth the full power, for a second thirty hours at 70 per cent. of the full power, and for eight hours at the maximum power, and during these respective tests no change can be made in the machinery, nor must any water be used on the bearings, while all the doors connecting the various machinery compartments must be closed as in war service. The trials were undertaken during the prevalence of a fog which extended from the Firth of Clyde along the Irish Sea and throughout St. George's Channel. It is generally the rule with Barrow-built ships that the trials begin with the slow speed, and continue at the medium speed, and finally close with the full speed, running with practically little or no break, but in this instance the fog interfered and upset this arrangement. The *Natal* was loaded to her full draft of 27 ft., at which she has a displacement of 13,550 tons, and she maintained a speed throughout the thirty hours of 21·35 knots. This speed was secured not only on the measured mile, but between given land-bearings, say between the Chicken Light on the Isle of Man and Cardigan Bay Light, making 22·7 knots with the tide, and on returning against the tide her speed was 20 knots, giving a mean of 21·35 knots, which exactly corresponded with her speed on the measured mile. The steam pressure in the boilers was 183·9 lbs., and the engines made 123·8 revolutions, the mean power being 15,937. The consumption of water was very much lower than the terms of the contract. The eight hours' full-speed trial resulted highly satisfactorily. The engines were run at 137 revolutions per minute, and her I.H.P. was 23,592, as compared with the anticipations in design, which was 23,500 I.H.P. The mean speed of several runs over the measured mile was 23·344 knots, compared with her designed speed of 22·33 knots, the result being more than a nautical mile above her guarantee. The propellers worked admirably, showing that the pitch as designed fulfilled the anticipations with the minimum loss of slip. The trial at one-fifth speed gave equally satisfactory results. One of the features of the *Natal* is that she is fitted up for the consumption of oil fuel as well as coal, a new departure in recent war vessels which has enormously increased the distance which a modern ship can travel, especially at a continuous sea speed, without requiring to re-coal. When the bunkers near the boilers are empty oil fuel can be burned, liberating the stokers for either work on deck if necessary, or giving them the leisure to remove coal from the other bunkers farther from the point of consumption. This is said to be an enormous advantage from a tactical point of view. The consumption of coal on the *Natal* gave very satisfactory results. With all her auxiliary machinery at work, the coal consumption was 1·8 lb. per I.H.P. per hour, and it is calculated that with oil fuel the consumption will be about 1 lb. of oil per I.H.P. per hour. The *Natal* has thus the power of steaming at 21½ knots speed a distance well over 4,000 nautical miles. The *Natal* is what may be described as an intermediate vessel between the "Devonshire" and "Invincible" classes. The 6-in. gun has been discarded, and she carries six 9·2-in. weapons and four 7·5-in. quick-firers, and can fire projectiles of 380 lb. and 200 lb. respectively. The muzzle energy of these guns has been greatly increased. All the guns are mounted in barbettes protected with 6-in. armour, and the whole of the broadside amidships is clad with 6-in. plating, reduced to 4 in. at the ram and 3 in. at the stern. There is an athwartship bulkhead to stop raking fire. It can thus be judged she is very effectively armoured. Torpedo guns (ten in number) are placed in a very advantageous position underneath her very high navigating bridge. There are also twelve of these guns aft. The *Natal*, after her trials, came back to Barrow, where she will be thoroughly overhauled and then handed over to the Admiralty. It was reported that the *Duke of Edinburgh*, on her trials, showed considerable disposition to roll in a beam sea, but in the *Natal's* trials nothing of this sort was experienced, which may be explained by certain alterations in her design after the *Natal* was well forward in construction.

Gas Producer.—Messrs. The Mersey Engine Works Company, Liverpool, recently received an order from Messrs. The British Westinghouse Electric and Manufacturing Company, Ltd., for a "Suction" Gas Producer of 360 B.H.P., the guaranteed time for delivery being one month. As this producer was for running on a multiple-cylinder engine, it naturally followed that it was necessary to make some special parts, and patterns had to be made, yet, in spite of this, the producer was delivered in the time, *i.e.*, one month.

THE SCREW PROPELLER CONTROVERSY.

(*Continued from page* 21.)

BEFORE leaving the hydrodynamics of the propeller, it might be well, though it lengthened his reply, to examine Mr. Froude's remarks on this point, as given in the discussion of his 1890 paper, which he had printed in full for distribution. It would be observed that Mr. Froude unfortunately again confused the issue, and made it appear that he said exactly the opposite of what he did say by using AE in Fig. 2 for the breadth of the blade and DE for the movement of the water by the blade in moving its own breadth, and then went on to say "during a complete revolution of the propeller the water moved not only as Mr. Howden says the distance ED (where AE is the blade width) but that distance multiplied by the number of times the blade width is contained in the distance of the spiral travel per revolution." Mr. Froude besides being in error in taking AE of Fig 2 as the width of the blade which gave a slip ED in moving its own width, for it was a width of blade equal to AC that gave ED, instead of using Fig. 3 of his (Mr. Howden's) 1890 paper, or Fig. 4 of the present (where the 10 per cent. slip illustration was shown correctly to scale and also the actual slip movement by the blade in the two close parallel lines) used Fig. 2, which in both papers showed the total slip *on the revolution*, to represent the slip on a movement of a blade width, a width which in this Fig. would be on the extreme diameter of the propeller equal to the whole convolution, or 68·62 ft. This was sufficiently confusing, but was much less than what followed, which was, as given above, "that he said the water moved not only the distance ED, but that distance *multiplied* by the number of times the blade width was contained in the distance of the spiral travel per revolution." How such a statement should be made after he had written all these papers to prove the exact contrary was difficult to comprehend. Anyone reading and accepting this statement of Mr. Froude must be impressed with the large volume of water dealt with by this propeller, not suspecting that this ED of Mr. Froude was actually only ·82 in. at 10 per cent. slip, and that instead of this movement being multiplied 37 times in a revolution, *remained at ·82 in. during the whole revolution*, though the screw dropped in the period 2·77 ft. in slip. Mr. Froude, notwithstanding all his (Mr. Howden's) explanations, apparently did not understand what he was criticising, as his statement reversed his (Mr. Howden's) geometrical proof. Mr. Froude, after this statement went on to refer to the case of the richocheting shot given by him as illustrating the great resisting power of water when suddenly struck by even such a body as a round shot, and said "The reaction derived from this and all other cases arises alike from the circumstance that water is not only set in motion but that it is *dismissed* in motion; and in all cases by the quantity set in motion multiplied by the speed with which it is dismissed. To dispute this proposition is to dispute not only the received theories of the propulsion of vessels, but the first principles of hydrodynamics." If Mr. Froude correctly stated here what were the *received* theories of the propulsion of vessels and the *received* first principles of hydrodynamics, he had no hesitation in saying that it was time these received theories and first principles received further examination. The illustrations he had given afforded sufficient reasons for rejecting these theories and principles as stated by Mr. Froude. A 100 lb. round shot of 9 in. diameter, when it struck the water at a high velocity and moderate angle, did not appear to sink more than its own diameter, and rose again instantaneously. It scooped out a very inconsiderable quantity of water which it drove forward, upward, and around, when it struck the water, and rebounded therefrom at a somewhat reduced angle. The resultant or direction of the reaction of these forces would be nearly perpendicularly downwards so that the quantity and velocity of the water dismissed to give the required reaction, according to Mr. Froude, must extend fathoms deep, the area struck being small and the forces great. Experience, however, showed that such reaction was obtained with extremely small motion of the water downwards. Should a small fish happen to be only a few inches right under the centre of the forces of reaction where this ball struck, it might receive a nervous shock, but no bodily harm from the "dismissed" water. Now this spherical shot, small but heavy, *striking* the water at such a tremendous velocity, say, 400 ft. to 500 ft. per second, must have a vastly greater effect in penetrating moving and dismissing water than that of a flat, broad, surface like a screw blade, which did not strike the water at all, but glided over it many feet under the surface at a high velocity, with a comparatively small pressure against the water per square inch of surface of blade. The water dismissed by the pressure of the blade face was a mere *bagatelle*, as his analysis showed. Multiplying its weight or quantity by the speed at which it was dismissed would not balance a hundredth part of the actual force of reaction given by the scarcely yielding water to the screw blades. There was, in short, practically no dismissal of water made by the screw blades at ordinary working slips, and therefore, according to Mr. Froude, no reaction. The accumulated movement on a particle of water from the beginning to the ending of the line across the blade was exceedingly small and the velocity was uniform. The last touch given by the blade, as well as the first, was infinitely small. There could, therefore, be no dismissal. Mr. Froude and his hydrodynamics had, in fact, here no material to work on. The particles moved did not rebound from the blade, but fell into the cavity left behind its body, which cavity, in proper screws, should always be greater than the quantity of water moved as slip by the face of the blade. These facts, brought to light by his analysis of the actual motions of the propeller, quite destroyed the hydrodynamical theory of its reaction in Mr. Froude's sense. The reaction of the propeller rested more on hydrostatics than hydrodynamics. Its fallacy, like that of Professor Rankine's theory, which Mr. Froude defended, lay clear on the face of it. Take, for example, the case which he (Mr. Howden) had tried again and again to bring home to the consciousness of his opponents on his question, that where the slip was reduced one-half, say, from 10 per cent. to 5 per cent., the engine power and revolutions remaining the same, the ship gained thereby an addition of 5 per cent. to her speed, the thrust and consequent reaction being necessarily increased to give the increased speed. This increased thrust was obtained by the power previously wasted in moving the double quantity of slip water being utilised for propulsion. Mr. Froude's hydrodynamic theory applied here would give the 5 per cent. slip and increased speed, with only half the water dismissed at half the velocity. By this hydrodynamic theory the increased speed of 5 per cent. would thus be obtained by *one-fourth* the thrust power required for the lower speed. Professor Rankine's theory, as he had all through shown in his various papers, was based on the same fallacy. It had always greatly astonished him how highly educated men should maintain such palpable fallacies when these had been pointed out and a real solution of the questions at issue had been shown to them. He knew nothing in the history of science to equal the behaviour of those experts who had employed themselves in formulating theories regarding the action of the screw propeller. Though it was evident that this strange anomaly had arisen by their holding on to theories based on imaginary and impossible assumptions instead of ascertained facts, the difficulty remained, *why* this should specially happen amongst experts dealing with the action of the screw propeller. He had already given his opinion that very much of the existing extraordinary confusion of ideas regarding its action was owing to the high and merited reputation of Professor Rankine, who so far back as 1865, when the screw propeller had but a short time before begun to displace the paddle-wheel in propelling ships, formulated his theory, which to mathematicians in naval and engineering circles, who had not thought out the subject for themselves, appeared to be a complete and scientific exposition of the subject. When once such a theory regarding an apparently complicated subject took hold, and was taught in Universities and in Naval Colleges, it became doubtless difficult to convince those who had been so educated of its erroneousness. But it was still difficult to understand how such special prejudices should have arisen in reference to this one subject. Those who studied impartially the history of these theories of the screw propeller must, he thought, be convinced that nothing had done more to prevent the true action of the screw from being understood and accepted than the false conception of a great sternward movement of the water being necessary to obtain the required reaction such as that on which Professor Rankine's theory rested. Examples of the maze of confusion and uncertainty existing in the minds of those who endeavoured to believe in

these theories could nowhere be better shown than in three papers of Mr. Froude read before the Institution of Naval Architects, two in 1899, and one in 1892. In these papers the evidently sincere but vain attempts to grapple with the insuperable difficulties of the Rankine column were painfully manifest. This blind following of recognised authorities was not, however, confined to Mr. Froude. It appeared to have affected all in the higher ranks of naval and engineering science. *Fourthly*, The long explanation of the action of the propeller blades given under the last head rendered it almost unnecessary to refer to this supposed centrifugal action of the propeller, though it was at one time very widely held, and as was evident from this discussion it still had a wide place in some minds. Centrifugal action could only be set up by an instrument revolving continuously among the same particles of water, which was exactly what was *not* done by propeller blades in screwing. It had been shown that the propeller blades were only in contact with the same particles of water for the merest fraction of a second, so that there was not the slightest tendency for the blades to set up any centrifugal action; on the contrary, the displacement of water, caused by the body of the propeller blades, was much greater towards the centre of the propeller where the large boss and the thick roots of the blades in their movements left large cavities to be filled up by the surrounding water, and necessarily caused a flow of the water from the outer parts towards the centre. This he had explained in his paper of 1878 where Fig. 6 illustrated the movement of the water towards the centre of the propeller. *Fifthly*, Mr. Froude in his 1886 paper did not give sufficient information to enable one to understand how his experiments with model screws were carried out to provide matter for a definite criticism. It was only recently by noticing some remarks by Mr. Barnaby in reference to Mr. Froude's trials with model screws, that he (Mr. Howden) came to learn that Mr. Froude's experiments were made in a similar manner to those recorded by Mr. Barnaby in his paper of 1890, read at the Institution of Civil Engineers. Mr. Barnaby's account of these trials was very interesting, and with the diagrams enabled one to understand the manner in which the slip and thrust were obtained, and the power as well as the curves of useful work and efficiency calculated. In these experiments by Mr. Barnaby the model screw was placed at the end of a shaft projecting from the bow of a steam launch driven by an independent engine which was supposed to give a speed to the launch, during the experiments, of 4½ knots. The model screw used from which the diagrams were made was 9 in. in diameter and 10·3 in. pitch. An independent engine turned the model screw which had necessarily to run up to 531 revolutions, or 456 ft. per minute, to attain the same speed as the boat when driven by its own screw at 4½ knots. Mr. Barnaby's diagrams showed, however, a positive thrust at 500 revolutions on the model screw, so that either the actual average pitch must have been greater than 10·3 in. or the speed of the launch at the moment these revolutions were taken must have been less than 4½ knots; very probably the latter, as the trials were made in the River Thames, where the speed could easily drop without being noticed. To create the various percentages of slip the model screw necessarily required to run at a higher speed than the speed of the boat, and consequently the power required to be increased as the slip was increased. At 500 revolutions of the model screw the slip was 9·5 per cent. and the thrust 1·75 lb. as nearly as could be measured on the diagram, while the power expended was about 1,200 foot-pounds per minute. At 600 revolutions the slip was about 17·3 per cent., thrust 6·6 lb., and power expended 4,000 foot-pounds per minute. At 700 revolutions the slip was 29·3 per cent., the thrust 12 lb., and the power expended 7,440 foot-pounds. The speed of the boat at 500 revolutions appeared to have been 3·83 knots, at 600 revolutions 4·2 knots, and at 700 revolutions 4·1 knots. The thrust here rose in a much greater ratio than the slip, more especially as between that at 500 and 600 revolutions than between 600 and 700 revolutions, the power expended also rising in a much greater ratio between the 500 and 600 revolutions than between 600 and 700 revolutions. The curve of useful work in these diagrams was illegitimately made up by multiplying the speed of the launch by the thrust of the model screw, that was, the thrust of the model screw was credited with the speed given to the launch by the launch's independent engine. Further, the efficiency curve was obtained from the useful work divided by the power expended. Fig. 22 was a copy of Mr. Barnaby's diagram showing the curves, thrusts, useful work, power expended, and efficiency, with varying revolutions. He understood Mr. Froude's slips and thrusts were obtained in the same manner as those of Mr. Barnaby, but instead of using a launch to carry his model screws, these were carried on a truck running on rails over a tank, where the speed of the truck would be accurately calculated and also the percentages of slip. The truck and model screws were also independently driven by separate engines, and the

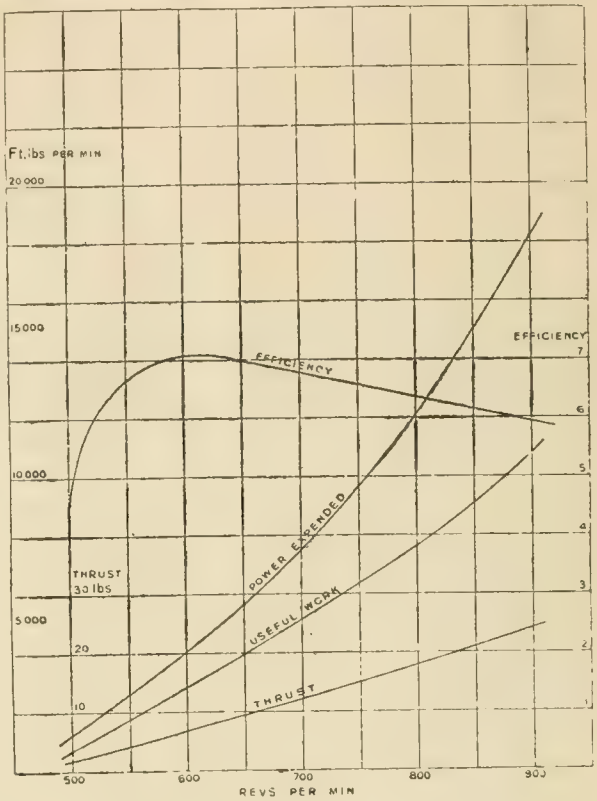


Fig. 22.

results calculated on the same lines as those employed by Mr. Barnaby, including that of the curves of thrust, power expended, useful work, and efficiency. If he was correct in supposing that Mr. Froude's data were obtained similarly to those of Mr. Barnaby, he must say that the process was entirely different from that of a screw propelling a ship, and that any deductions from these experiments applied to the case of a propeller working with slip in a steamship would be entirely misleading. In a steamship when large slip was being made, the engines were generally working at a less power than when small slip was made, and with fewer revolutions. In these model experiments even moderate slip could not be made at all without increasing both power and revolutions largely. In a steamship with engines at the same revolutions as when a small slip was being made, the slip might be trebled or more than trebled without any increase of power being used, or even with a less power. This depended very much on the form of the blades, but, at all events, more or less slip was not dependent, as in the model screw trials, on more or less power and revolutions of the engines. Mr. Froude's model experiments were quite inapplicable to the case of ship propelling, as these artificial slips, as they might be called, of the model screws were entirely different from the natural slips occurring in propelling. In the latter no increase of power or revolutions was required to make slip, while in the former an appreciable slip could only be made by a large increase of power and revolutions. Mr. Froude's endeavour in his criticism of his (Mr. Howden's 1890 paper) to prove that a trebled slip produced a trebled thrust had evidently arisen from his being misled by taking the results of model experiments as being applicable to ordinary screw propelling in a ship. Arguments could be multiplied to show that there was no legitimate connection between these experiments and ship propelling, but he thought enough had already been said to prove this fact. It would be seen

that he was correct in what he said, in criticising Dr. Caird's paper on "Propeller Diagrams" that, the efficiency curves given in that paper, made up on Mr. Froude's 5th Proposition, were entirely misleading, being based on ideas having no foundation in fact. A screw of the highest efficiency was one that in any given case gave the highest speed to the vessel it propelled with the least expenditure of power. Mr. Froude's highest efficiency was, he might say, obtained on almost the opposite conditions, the expenditure of power in obtaining the so-called efficiency having apparently been forgotten. *Sixthly*, That he neglected or controverted Newton's three laws of motion. This was rather an amusing charge. In his investigation of the propeller he did not trouble himself about these laws of motion. What he was concerned about was establishing the actual facts connected with the action of the screw propeller under any given conditions of working. This, he believed, he had accomplished. If so, then he was quite sure that Newton's laws would be satisfied. They always supported facts. Having now noticed the principal points of his paper criticised by those who had taken part in the discussion, he might now refer shortly to the individual character of their remarks. Beginning with his friend, Dr. Caird, he might confess that before hearing his remarks, he felt considerable curiosity as to the manner in which he would treat his demonstration of the real action of the propeller and the erroneousness of the Rankine and analogous theories, which demonstrations he so emphatically asserted had been absolutely refuted in all the discussions which followed the reading of his former papers. Of course, he naturally hoped that Dr. Caird would do what was right by acknowledging his mistake and making an apology, both on his own account and in the interests of truth and justice. Remembering, however, the astonishingly uninformed condition of most audiences on this subject, he feared that Dr. Caird would, instead of doing what he ought to do, evade the issue, and back out of it by some stratagem. He knew if Dr. Caird attempted a straightforward frontal attack by counter geometrical and quantitative demonstrations, the result would be an open defeat, as his weapons would prove his own destruction. If, again, he attacked from behind his allies or champions, using them as a screen, those who, he had asserted, had in the discussion of his former papers utterly destroyed his (Mr. Howden's) demonstrations, he knew he would also fail. These champions, as he had shown in his paper, instead of being victorious, merely showed their own misunderstanding of the subject and their failure to deal with his demonstrations. The tactics which he feared Dr. Caird would resort to had actually been followed. Dr. Caird had entirely refrained from approaching the questions at issue. His direct challenge Dr. Caird left wholly unanswered. The real matters under discussion were left unnoticed. Instead of occupying himself with arguments on vital points, Dr. Caird began a specious narrative, effusively candid in appearance, and went round the outskirts of these issues as if busy with them, but never approached them. After thus raising a veritable cloud of words, he eventually rode off under cover of this cloud as if he had again "completely and conclusively refuted" all his (Mr. Howden's) demonstrations by merely repeating his original statement to this effect. If such methods of conducting arguments on controverted points on mechanical subjects were believed to be fair or admissible by those who employed them, they must either hold the reasoning capacity of their readers or audience very cheaply, or have themselves a very inadequate idea of what was due to opponents in the conduct of such arguments. It might be of interest to notice some special features in the manner and matter of Dr. Caird's treatment of his (Mr. Howden's) demonstrations *now*, compared with his tremendous attack of 1896. Dr. Caird was now extremely mild and apologetic, and, while endeavouring to maintain his original position, this was diplomatically kept in the background and not openly asserted. Dr. Caird also spoke in a fine spirit of humility of his own 1895 paper on "Propeller Diagrams," as being a mere nothing to raise all this trouble about, "a mere step in the evolution of the analysis of the action of screw propellers," and ignored his own introduction to that paper as follows:—"Mr. R. E. Froude's 1886 paper, read before the Institution of Naval Architects, marked an epoch in the investigation of the properties and behaviour of the screw propeller," after which he quoted the "fundamental propositions" laid down by Mr. Froude in this paper, culminating in the famous 5th Proposition which Dr. Caird found so effective as to be beyond praise, but which he (Mr. Howden) unfortunately, after examination, could not find that it in any manner solved any material question regarding the propeller's action. It must also be remembered here that the title of this 1886 paper of Mr. Froude's was "The Determination of the Most Suitable Dimensions of Screw Propellers," an object of the most important character connected with the propeller. It was remarkable that Dr. Caird's tactics should now lead him to so belittle his own, and his champion's paper. This was consistently carried out to the fullest extent, as Dr. Caird now meekly declined to defend those champions who, he formerly affirmed, had entirely demolished his (Mr. Howden's) papers. Dr. Caird, for example, had not a word now to say in support of Dr. Inglis's wonderful column of *indefinite length* to which the screw added pieces of 25 ft. each revolution, but which he held could be easily measured and weighed, or that other still more wonderful column of this same champion made up of films an inch or more thick each revolution, until a full column was made up, nor did he even defend Mr. Froude's wonderful propellers which required a trebled power to force them to make a trebled slip. Even Dr. Caird's former accusations against him of "gross and palpable blunder," and other improprieties in his criticism of the "propeller diagrams" paper, which he had shown to be quite a mistaken charge, were now conveniently forgotten. Dr. Caird continued his remarks in the same mild strain regarding the author's geometry, which, though he still held it refuted by Mr. Froude, yet considered it faultless so far as it went. The author had already dealt with this point as well as the impossibility of his methods, if carried further, yielding, as Dr. Caird thought, results identical with Rankine and Froude. He had further also showed good reasons for standing alone against all the reputed leading authorities on the hydrodynamics of the propeller's action, and did not, therefore, require to say more on this subject. He only stopped one moment to notice Dr. Caird's figures given in illustration of the applicability of Mr. Froude's curves to the case of the two screws in the same ship which he gave ten years ago, in disproof of Mr. Froude's 5th Proposition being a guide in determining the more suitable dimensions of propellers for steamships. Dr. Caird here showed how he would apply Mr. Froude's curves to the case mentioned so as to produce screws on these diameters which would give the highest efficiency. The particulars were as follows:—

Diameter.	Pitch ratio.	Revolutions.	Slip ratio.	Efficiency.
12 ft.	1·1	94	20 per cent.	1·000
10 ft.	1·1	124	26 per cent.	·975
10 ft.	1·6	94	33 per cent.	·940

It should be remembered that the two screws mentioned by the author which were applied to the same ship gave equal speed with the same power and revolutions of engines, the pitches being alike and the surface of blades nearly alike, though differently disposed. The revolutions of the engines were under 70, and the slip from 5 to 10 per cent. according to weather, loading, &c. According to Dr. Caird, Mr. Froude would have wanted a slip ratio of not less than 20 per cent. for the 12 ft. screw, the pitch ratio being 1·1, highest efficiency being attained with 94 revolutions. For the 10 ft. screw with a slip ratio of 26 per cent., pitch ratio also 1·1, and 124 revolutions per minute, the efficiency was 2½ per cent. less than that of the 12 ft. screw. An alternative was given for the 10 ft. screw with a slip ratio of 33 per cent., the pitch ratio being 1·6 and the revolutions 94, the efficiency in this case being reduced by 6 per cent. from that of the 12 ft. screw. A more complete condemnation of Mr. Froude's formula could not have been given than was given by these figures of Dr. Caird. The revolutions, to begin with, would have been entirely unsuitable for the engines, if not impossible, while the power necessary to give the speed at these revolutions with such great percentages of slip would probably have been at least 20 per cent. more for the 12 ft. screw and 30 per cent. for either of the 10 ft. screws. As he had before said, Mr. Froude's efficiency was not concerned with the power expended, and the waste by slip was entirely ignored. In conclusion, he regretted to find that Dr. Caird, without bringing forward one proof, or one tangible argument, in support of his assertion that the author's papers on the screw propeller were completely and conclusively refuted in the discussions which followed their reading, should consider it justifiable to reiterate that he still considered Mr. Froude's remarks in the discussion of his 1890 paper "a conclusive refutation of the arguments advanced by Mr. Howden in that paper." The remarks of Mr. R. E. Froude

were, he regretted to say, of a character which did not do justice either to his personal or inherited reputation. Mr. Froude tried to belittle his work on the screw propeller as something of no moment whatever, and considered his propositions were merely of an elementary character, and already premised by those investigators whose work he denounced. Nor did he appear to Mr. Froude to have got beyond the A B C of the subject, who questioned if he had even attained the B C. He also appeared to Mr. Froude to lack the knowledge of the science of hydrodynamics, and until he proved he possessed such knowledge Mr. Froude would consider it a waste of time to concern himself with his criticisms. The character and spirit of such remarks placed them outside the pale of ordinary treatment. They had evidently been written under the influence of some feeling. It would give him all the more regret if his probably rough banter over Mr. Froude's masterful screws had led to any irritation. He had no thought, and certainly no intention of giving offence, and regretted if he had unfortunately done so. His old friend and former antagonist on this subject, Dr. Inglis, had sent a characteristic communication, but not, he thought, in his happiest manner. Dr. Inglis had, he found, now retired from the contest, feeling doubtless in this case that "discretion is the better part of valour," and had taken shelter behind "Rankine, Froude, Barnaby, and others." Dr. Inglis's memory must have failed him in saying, regarding his paper of 1878, that he had offered a few remarks on it at his request, as, previous to his taking part in the discussion of that paper, he (Mr. Howden) had had no communication whatever with him on the subject. He remembered, however, having sent him a corrected copy of that paper, which he got printed and sent to some of the members of the Institution after the Transactions had been published, it having been, by mistake, printed there without some corrections he had previously made. The true theory of the screw propeller was not yet buried, as Dr. Inglis supposed, it was just beginning to come to fuller life. The remarks of Professor Robertson were altogether so much out of line with all his views of the propeller's action that the time and space at his dispsal did not permit of noticing them individually. He would only ask Professor Robertson to do him the honour of reading his paper and studying his demonstrations and diagrams without bias, if possible, as he was sure this would correct most of his opinions. Professor Robertson would find that the water, and nothing else, was the nut in which the screw worked, that the water did not rotate with the screw, that the blade did not suddenly strike the water, or that the water—like a pugilist—in return struck back a blow on the blade. The blade was immersed in the water, and if a proper screw were used the two worked in harmony and quietness. Professor Robertson's proposal, to test the action of the propeller by placing circular discs fore and aft of it so as to prevent longitudinal motion of the water, and then to remove them suddenly when full speed was obtained, had this fatal objection, it could not be carried out because the vessel would never attain any speed under these conditions, as the screw would by them be prevented from screwing. On the other hand, the thin metal cylinder shrouding the periphery of the blades so as to prevent the radial action which Professor Robertson supposed to be the principal action of the screw, would scarcely interfere with its efficiency instead of destroying it altogether, as Professor Robertson thought it would. Professor Robertson admitted he was but an outsider in shipbuilding matters, which indeed was evident. He hoped, however, a further study of his paper would lead him to change most of his present beliefs regarding the action of the screw propeller. Professor Jamieson considered he ran counter to Newton's laws, but as this evidently arose from his neglecting to take the friction of the blades into account, he had no doubt that when he informed Professor Jamieson that he had, as stated in this and all his other papers, purposely eliminated friction, Professor Jamieson would exonerate him from any antagonism with Newton's laws of motion. He believed also Professor Jamieson would, for the same reason, admit the correctness of his Propositions 2, 5, and 6. Professor Jamieson, in referring to the Rankine theory and the application of the formula $\frac{Wv}{g}$ undertook to show no less than "three distinct mistakes" in this application; but Professor Jamieson, in so proposing, could not have read his paper very carefully, as he was not at all responsible for the application of this formula to the Rankine column. It was all the other way. He quite objected to the formula $\frac{Wv}{g}$ being used at all. It was Professor Rankine's own formula, as applied by himself in illustrating his theory, and he merely showed how condemnatory it worked out for his theory when applied to different percentages of slip in the same steamship. Professor Jamieson's attack on the formula of the Rankine theory was, therefore, all thrown away on him, as it was not his formula but Professor Rankine's. He ventured to suggest, however, that Professor Rankine was not so ignorant of Newton's laws as Professor Jamieson's criticism of this formula seemed to imply. The remarks of Mr. James Hamilton bore so much on matters concerning the action of the propeller which he had already fully explained in reply to similar criticisms that he need not again refer to them. Mr. Hamilton would find he had fully shown that the difference between Professor Rankine's theory and his (Mr. Howden's) was radical and complete instead of being very much alike. Mr. Hamilton was necessarily quite wrong in supposing that the screw blades in the Allan Line turbine steamers cut up the whole water spaces between the blades "so that he would be forced to admit that the whole column was moved astern." He did not admit that any column of water whatever was moved astern, as there was no column to move. Nor did he admit that the water spaces between the blades were entirely cut up. Such ideas could only arise from entirely neglecting the geometry of the screw's action. If the water were entirely cut up by the screw blades working so closely to each other, the ship would necessarily have no speed. The water was only moved equal to the slip of the revolution divided by the breadth of the blade, as he had explained, and it would be found to be a comparatively small amount unless the screws were working with excessive slip, which he had no reason to suppose was the case. Mr. Hamilton made a very extraordinary statement in saying that "Dr. Froude, a year after he (Mr. Howden) read his paper in 1877, practically covered the whole of his seven propositions." It would have been flattering to him if Dr. Froude had done so, but nothing could be further from the actual facts than this statement. Dr. Froude's ideas on the subject were entirely opposed to his, as were shown by the conclusions arrived at. It was unnecessary to say more on this point, as anyone could ascertain its correctness by reading Dr. Froude's paper of 1878 and his (Mr. Howden's) papers of 1877 and 1878. He had reserved Mr. Luke's remarks for special notice, they being of a somewhat special character. Mr. Luke began by telling how that Dr. Caird's remarks had cut the ground from under his feet, so thoroughly did he concur in Dr. Caird's views regarding his paper. Mr. Luke then went on to explain why he, as a young man, took part in the discussion, and how at the previous meeting he was prepared to listen with sympathy to his paper, but unfortunately found it of a character that very unfavourably impressed him when hearing it read, an impression that was intensified on carefully reading it over afterwards. Mr. Luke went on to explain that what had roused him so powerfully were his (Mr. Howden's) remarks on page 6, and also the quotation, "that, though at the discussion of my 1890 paper, mathematicians of the highest rank, whose theories I had controverted, took part, not one challenged my geometrical and other demonstrations either of the true action of the screw or of the erroneousness of the theories of Rankine, Froude, and others," which remarks and quotation Mr. Luke said "could not be described as anything else than disingenuous." Further, Mr. Luke continued, "he hoped that members would refer to that discussion and see for themselves exactly what was said, and they would find Mr. Howden's remarks conveyed a false impression." Mr. Luke went on to tell that Mr. Froude completely controverted him in that discussion, Mr. McFarlane Gray was crowded out for want of time, Professor Greenhill made a few complimentary remarks, &c. In reply to all this, he would merely repeat what he had said in his paper and call attention to the fact that all those whose views he had controverted had advance copies of his paper sent them at least a week before it was read, so that they might be prepared to take part in the discussion. Mr. Froude, Professor Greenhill, and Mr. McFarlane Gray had full time at their disposal for making whatever remarks they had prepared. He was, in fact, the only one "crowded out."

(To be continued.)

LARGE TESTING MACHINES IN SOUTH WALES, 1829-1906.*

By Mr. J. Hartley Wicksteed, Past-President, of Leeds.

THE author has on previous occasions contributed to the Proceedings of this Institution Papers on a Single-Lever Vertical Testing-Machine† of 50 tons capacity, and on a 100-ton Universal Testing-Machine‡ of the horizontal type.

There has been installed at Lloyd's Bute Proving House, Cardiff, a 350-ton horizontal machine of the author's design, for the purpose of testing the largest anchors used in the British Navy, or the mercantile marine, with the statutory proof-load, and for ascertaining the breaking load of the largest cables now used. Fig. 1 shows a wrought-iron stockless anchor weighing 61 cwt 1 qr. tested to 49 tons on this machine. Fig. 2 shows three links ready for testing. Fig 3 shows three iron links of the $3\frac{3}{4}$-in. diameter cable for the Cunard Express steamship *Mauritania*. The proof strain of this cable is 189·8 tons, and the breaking strain 265·7 tons.

No. 2 sample broke at 347·9 tons = 83·2 per cent. above proof strain.

No. 5 sample broke at 348·5 tons = 83·5 per cent. above proof strain.

No. 8 sample broke at 324·5 tons = 70·9 per cent. above proof strain.

No. 12 sample stood 350·0 tons without showing any sign of defect.

These latter three links elongated 2·42 in. at 265·7 tons, and 5·7 in. at 350 tons. The machine stood the sudden breaks with comparatively small vibrations. A similar sample of chain stood 370 tons without showing any signs of defect. These particulars with Figs. 1, 2, and 3, have been contributed to this Paper by Mr. George W. Penn, Superintendent of Lloyd's Bute Proving House. They will enable members to realise at the outset the kind of work which the 350-ton testing-machine is used for.

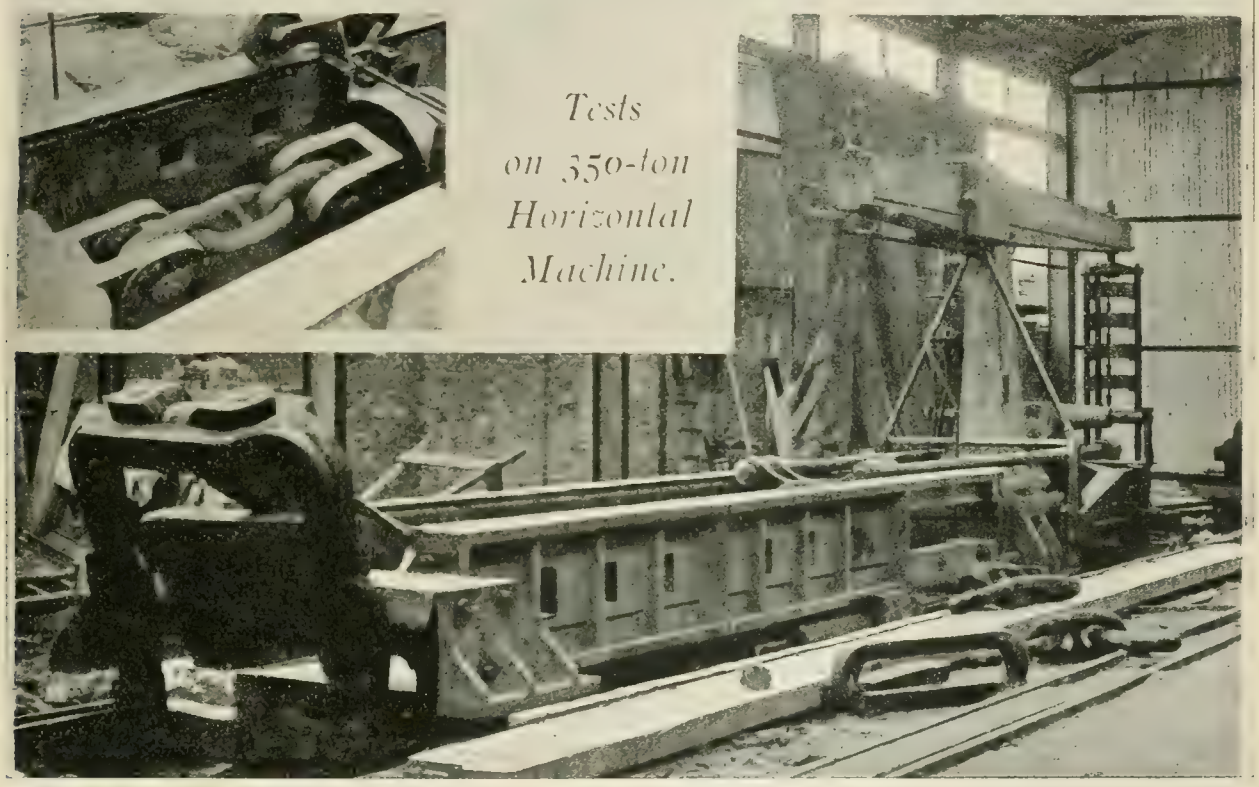
But, before describing this machine, which illustrates the most recent development in testing-machines, it will be interesting to place on record a description of the very first testing-machine ever constructed, which combined the same essential principles as the most approved modern machines, namely, hydraulic power for straining the specimen and dead-weights acting through levers with knife-edged fulcra for measuring the load. It is remarkable that this earliest machine was started in 1829 in the county of Glamorgan where the present latest and largest machine has also found its home. Fig. 4 shows the machine of 1829. It was made at Cyfarthfa Iron Works, Merthyr Tydvil, from the design of Mr. William Williams, then engineer to the works. The original working drawings were preserved by his son, the late Mr. William Williams, civil engineer, of Merthyr Tydvil, who, in succession to his father, also held for some years the post of engineer at Cyfarthfa.

It happened a few years ago that the author was making a research into the history of testing-machines, and through his friend and partner, Mr. Christopher James, he was put into communication with the late Mr. Williams, and therefore is now able to produce authentic drawings, which have never before been published, of this

Fig. 2. *Three Links in Machine, ready for testing.*

Fig. 1. *W.I. stockless Anchor weighing 61 cwt. 1 qr. tested to 49 tons on Machine.*

Tests on 350-ton Horizontal Machine.



Large Testing Machines.

*Read at the Cardiff meeting of the Institution of Mechanical Engineers.

†Proceedings 1882, page 384.

‡*Ibid*, 1901, Part 4, page 933.

interesting historical machine. It will be seen that the machine is made with two columns, the upper part of which form hydraulic cylinders, and a crosshead raised by these cylinders carries the top shackle for straining the specimen. The bottom shackle lifts a lever of the second order connected to a steelyard on which dead weights are loaded. The levers are mounted on knife-edged fulcra throughout, and care has been taken to arrange all the

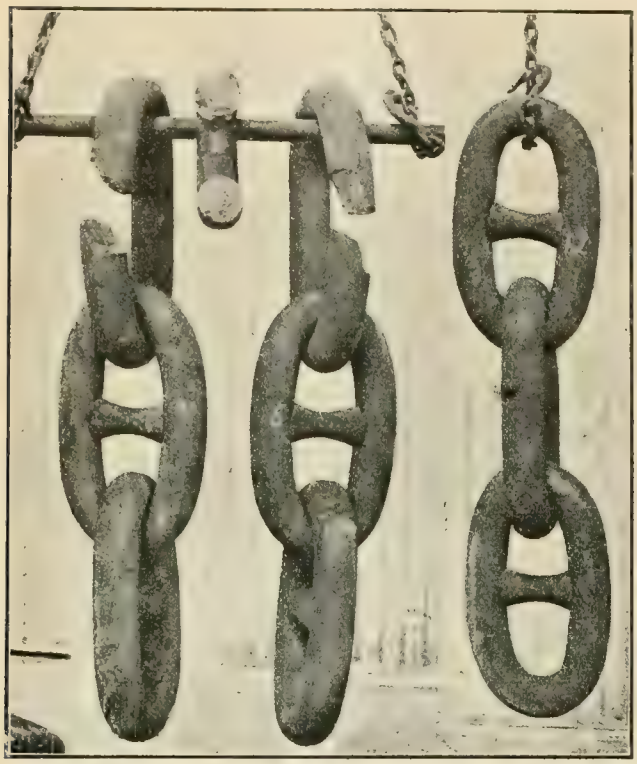


Fig. 3.—Three Links of 3¾ in. Diameter—Cable.

For Cunard Company's ss. *Mauritania*. No. 2 broke at 347·9 tons. No. 5 broke at 348·6 tons. No. 8 broke at 324·5 tons. No. 12. stood 350 tons without any sign of defect.

knife-edges in strict alignment, which makes them capable of exact measurement. The machine would test up to loads of 130 tons, and Mr. Williams made experiments with it on riveted joints, with lap joints, with single butt-straps, and with double butt-straps, and also upon iron bolts up to 2 in. square. His records of load are astonishingly high, reaching over 30 tons per square inch on wrought-iron bolts.

The author will leave it to others, who know the history of iron in South Wales better than he does, to say whether bolts could be made in South Wales in 1829 giving 30 tons per square inch of strength measured on the original sectional area. But if Mr. Williams reckoned his load upon the fractured sectional area, instead of the original sectional area, there would be no difficulty in accounting for the high results which he obtained. Simple as this machine may seem, it is a proof of true genius in the designer that he adopted those essential principles which have held their own in competition with every other device for three-quarters of a century and still continue to hold the field.

Fig. 5 shows a plan of the 350-ton machine now working at the Lloyd's Bute Proving House; Fig. 6 shows an elevation, partly in section, of the steelyard end of the machine, and general views are shown in Figs. 1, 2, and 7. It will take in anchors 17 ft. long in the stem, and 7 ft. 6 in. wide across the palms. It will impose the statutory breaking strain on stud links made of 4½ in. diameter iron, and in doing so has 40 tons of power to spare. This margin of power is, however, quite necessary to meet the excess of strength with which chain cables are now made beyond the statutory minimum. The scheme of the machine is set forth in Fig. 5, which shows a horizontal hydraulic cylinder in section with a ram having a 5-ft. stroke. This ram pushes out a sliding bed at the end of which a cast-steel anvil is carried, against which the palms of the anchor bear. The stem of the anchor is shackled to the fork B which is carried by a parallel frame supported on anti-friction rollers and made with a crosshead C at the back which delivers the pull on to the lever system.

In testing links the one link is attached to the fork A, the other end to the fork B, and as the hydraulic ram pushes out the sliding bed, it carries with it one end of the link while the other is held from the fork B on the weighbridge, which delivers the pull as before on to the steelyard. The steelyard carries not only a travelling poise-weight but also a suspended rod, on the end of which standard weights can be dropped. By this means the scale unit is sufficiently large for testing ¼-in. diameter iron as accurately as large cables with 350 tons of load. But to make the same machine available for testing heavy and light loads with an equal percentage of accuracy, it is necessary, besides having a larger scale unit, to so construct the machine that the knife-edged fulcra may distribute the heavy load over such a length of bearing as to allow the fulcra to be brought to a keen edge to give sensibility for light work and still not to crush in doing heavy work.

Fig. 5 shows the main fulcrum, which is 6 ft. long, and it will be seen how rigidly both the knife-edge and the bearing plate are supported throughout their length, so that they cannot spring apart in the middle and thus bring more pressure on one portion of the bearing than another. The regulation of the Board of Trade, with which these fulcra comply, is that the pressure shall not exceed 5 tons per lineal inch of knife-edge. By using very hard steel it is found that the fulcra will stand endless repetitions of this pressure statically applied, but if they are allowed to chatter by the reactions of the machine when the rupture of the specimen occurs, they are liable to serious damage.

It is a curious coincidence that the machine of 1829 had the straining shackle free to rebound on the rupture of the specimen, while the lever system remained undisturbed owing to its being at the same end as the stationary part of the machine. Similarly, in this machine of 1906, the levers are mounted on the stationary part of the machine, and the straining crosshead is free to rebound without chattering the knife-edges. Imagine the water in the cylinder compressed to one ton per inch and a hard speci-

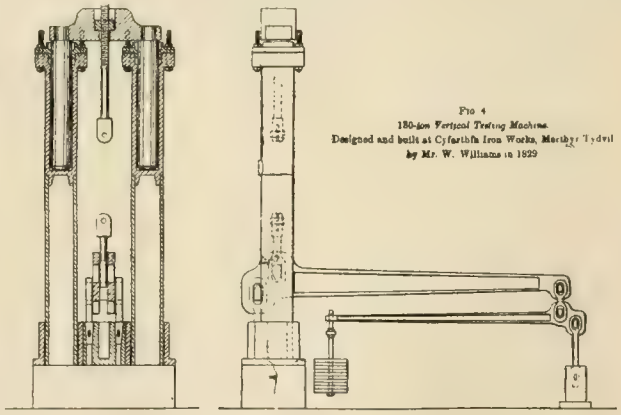


Fig 4
130-ton Vertical Testing Machine.
Designed and built at Cyfarthfa Iron Works, Merthyr Tydvil by Mr. W. Williams in 1829

men fracturing suddenly, then the elastic compression of the water and the elastic recovery of the containing vessels tend to shoot the ram out of the cylinder. The design of the machine is such that all statical stresses are self-contained between the cylinder and the sliding bed, and are taken symmetrically along the centre of gravity of the

sections. The bed-plate and foundations are inert and entirely unstrained, but when the piece breaks and the statical stresses are released the sliding-bed is free to shoot out and relieve the elastic pressures referred to, but the cylinder which carries the fulcrum plates is restrained from any perceptible recoil, first of all by its own mass, secondly because it is bolted to the bed-plate which underlies the whole length of the machine from end to end, as is clearly shown in the general view, and thirdly because this bed-plate is bolted and keyed to solid foundations. With this construction there is no sensible kick upon the knife-edged fulcra, and their accuracy is unaffected even by such violent reactions as take place on the sudden release of a 350-ton load.

The sliding-bed in this form of construction enables a movable straining crosshead to be locked at any part of the bed, so that the straining head can be brought close up to the weigh-bridge to test as short a sample as a rivet, or rolled away to any suitable distance for holding longer specimens without the use of making up lengths.

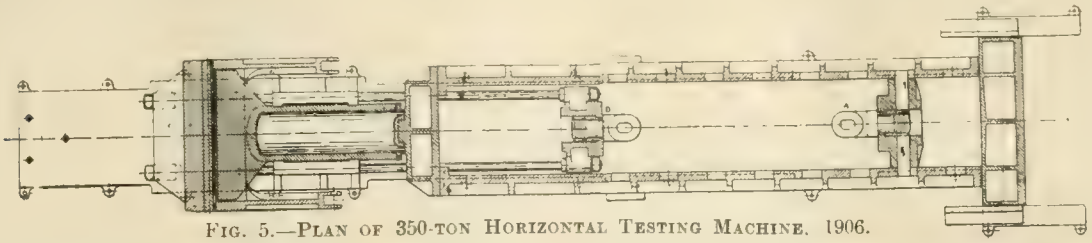


FIG. 5.—PLAN OF 350-TON HORIZONTAL TESTING MACHINE, 1906.

The weight employed for measuring the load is divided between stationary weights at the long end of the steelyard and a rolling weight which, by the introduction of a double-armed steelyard originated by the author, counterbalances it by passing on to the negative end of the lever, Fig 6. Thus the rolling weight of half a ton on this machine is balancing another half a ton concealed in the long end of the steelyard. As the poise-weight rolls, the concealed half a ton is gradually released, so that the centre of gravity of the whole steelyard system travels at half the rate of the visible scale. The effect of this is that the scale-unit is double the size that it would be,

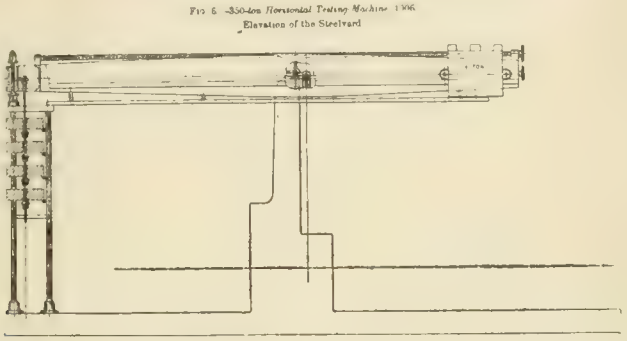


FIG. 6.—350-ton Horizontal Testing Machine, 1906. Elevation of the Steelyard.

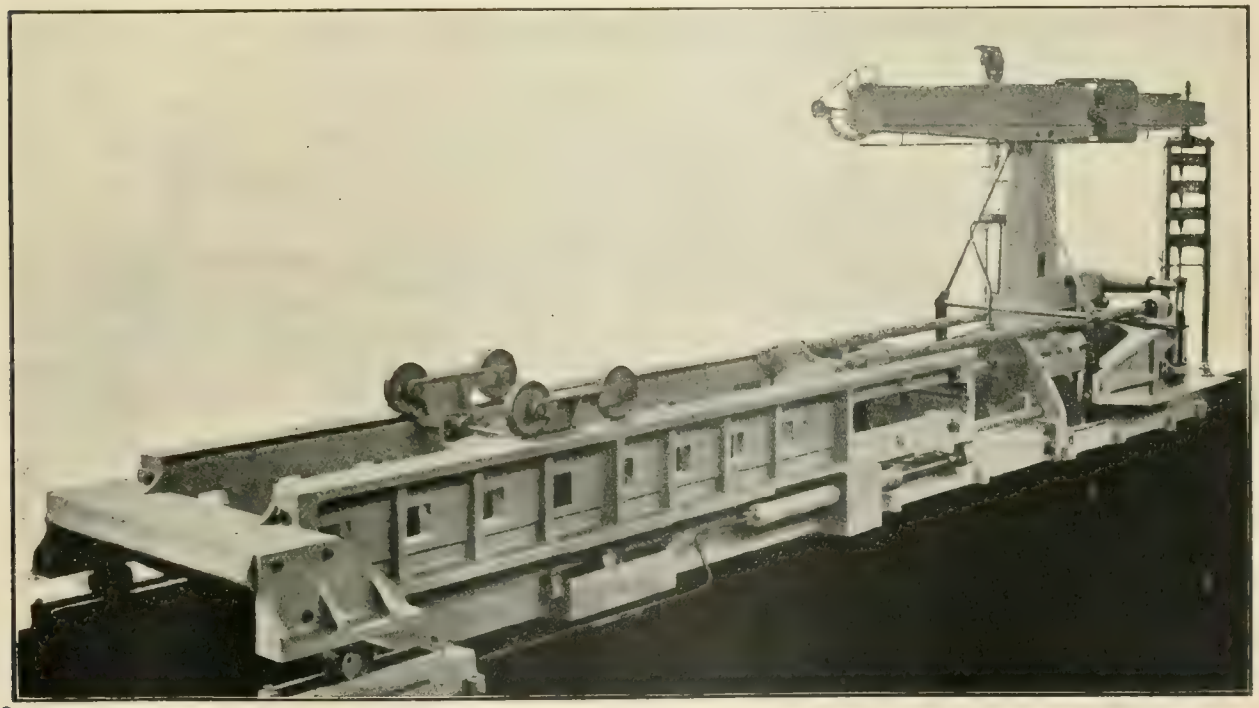


FIG. 7.—GENERAL VIEW OF 350-TON HORIZONTAL TESTING MACHINE, LLOYD'S BUTE PROVING HOUSE, CARDIFF.

were a one-ton poise acting on the long end of the lever only, and at the same time the required poise is only half the weight.

A further good effect of using a double-arm steelyard in connection with a rolling poise is that the unrecorded inertia resistances are only half what they would be if a single-armed steelyard were employed with a one-ton weight with its zero on the axis of the steelyard; for in this case the positive arm of the steelyard would require to be balanced by a stationary counter-weight at the negative end, and the weight of the whole oscillating mass would be approximately double what it is when the poise itself counterweights the lever, by making its zero at the balancing point on the negative end of the steelyard. The double weight would arise as follows: Firstly, the concealed half-ton of overweight at the long end would need to be balanced by an extra weight of equal amount at the negative end; secondly, the poise would be doubled in weight; and, thirdly, the whole lever would require to be made heavier to hold up at its long end a rolling poise of one ton weight with the same stiffness that it holds up the rolling poise of half-ton weights.

To revert for a moment to the comparison between the Cyfarthfa machine of 1829 and the Cardiff machine of 1906. The similarities in the elementary principles have already been described; the essential improvements of the latter machine over the former consist chiefly in the introduction of a poise rolling on a double-armed steelyard, and of a movable straining head locked in a sliding frame, by which the clip boxes may be brought close enough to test a rivet, or to any distance apart required for breaking the links of chain cables; and, of course, also such perfecting of details as has resulted from extended experience, and the close attention of many workers in this field, amongst whom the author feels particularly indebted to Mr. Thomas Traill, E.E., late Engineer Surveyor-inChief to the Board of Trade, and to his successor, Mr. Peter Samson.

In conclusion, the author thinks that, considering the number of "sports" in the genus testing-machine which have sprung up and died out or become obsolete during the intervening period, it is noteworthy to find that the Cardiff machine, for the installation of which our Vice-President, Sir William Thomas Lewis, is responsible, confirms the soundness of the main principles which were first brought into practice so long ago in this same County of Glamorgan; and it is a pleasure to have had this opportunity of reviewing and bringing to light the work of the Cyfarthfa pioneer who, long before the author was born, constructed the prototype of the most modern testing machines, including the Bute Proving House Chain and Anchor Testing Machine of 1906.

INSTITUTE OF MARINE ENGINEERS.

On August 18th the Institute of Marine Engineers paid a visit to the Walthamstow Power Station, and were shown over the works by the chief electrical engineer, Mr. Spurr, ably assisted by his second in charge, Mr. Taylor. It was very satisfactory that many junior members of the Institute availed themselves of the opportunity thus afforded of examining the details of the machinery. The premises lie near the Hoe-street station on the Great Eastern Railway, but as there is no tall chimney, the outward and visible sign to indicate that electric power is being generated to such an extent for light and traction as was subsequently revealed to the visitors, it was apparent that a more modern system of providing power than that of coal burnt in the furnace, with its accompanying smoke, was in vogue. It was found on entering the works that all the plant is run by the Dowson Producer Gas Plant.

The station has thirteen sets of dynamos driven by gas engines, about half being used for traction, the other half for lighting. For each of these there are large accumulators or storage batteries, into which surplus current off the machines running can be stored for use as required.

The engines can be started and attain maximum speed within one minute, the starting being done by admitting air, compressed to 200lb. per square inch, into the cylinder. It is immediately shut off on completing one or two revolutions, the gas being then admitted by the necessary gear.

In the traction section there is a most important device called the "Booster," which equalises the amount of current required for the traction mains. There is unavoidably a fluctuation of load on the tramway system, requiring a greater or less amount of current than one machine gives out. To run one machine is barely sufficient at one period, and more than sufficient at another period, so through this "Booster" the current is augmented to the mains from the accumulator, or the surplus from the dynamo stored in the accumulator. The fluctuations out or in are shown by meters, and also by a diagram.

The water for cylinder-jacket cooling is circulated by a motor-driven force pump, the water being cooled by the usual tower coolers outside the main buildings. The water for this and boiler purposes used in the gas generation is got from an artesian well, augmented by water from the town mains.

The Dowson Producer Gas for the station is generated in two gas houses, each containing four producers, and stored in two gasometers. All the gas producers are not required for the ordinary running, a certain number being off for cleaning, and others damped down until required for extra power. The damping down of these only requires about 1½cwt. of anthracite coal per producer per day, showing that great power may be kept in reserve at small cost.

After an instructive and pleasant afternoon a hearty vote of thanks was proposed by Mr. A. Boyle to Mr. Spurr, electrical engineer, and Mr. Taylor, second in charge, for the patient and painstaking way they had shown and explained the machinery and plant under their charge, as well as for the pleasure and education which their visitors had received. This was suitably seconded by Mr. Hawthorn.

Mr. Spurr, in reply, expressed his pleasure in receiving the members of the Institute that day, and had no doubt that the invitation to pay a further visit would be accorded by the Council if desired, and such an invitation would certainly be endorsed by himself.

Board of Trade Regulations for Engineers' Examinations.—The Board of Trade have recently issued an official copy of their regulations relating to the examination of engineers in the mercantile marine. This is a reprint of the 1904 edition, with certain alterations, and gives information which is useful to examiners, as well as examinees, and all those concerned in the subject, which naturally covers a wide field. The general rules give extracts from the Merchant Shipping Acts, showing the requirements as regards officers on board vessels, and the necessity for certificates, with the qualifications desired, and the fees to be paid by candidates. The various grades are then described, commencing with second-class engineers, followed by first-class and extra first-class. Full details are given in each case as to what the examiners will require from each person presenting himself, and we note that engineer officers in the Navy are entitled, without examination, to certificates. In Chapter III. we have the conduct of these examinations given fully described, with the penalties involved for infringement and in several appendices which follow we find the days of examination at the several ports, the forms to be filled up by candidates, and a list of elementary questions set. These apply to all classes of apparatus met with in an engine-room. There are particulars also of the examination set in rough working drawings for a first-class engineer's certificate of competency. Importance is evidently attached to reading the water gauges correctly, as we find not only a description of requirements but drawings of these details in order to exemplify the matter thoroughly. We have general views as attached to a boiler, and also sections of the gauges themselves. Particulars are found also of the examination for masters and mates to qualify in steam, and we have also a list of colonial certificates which are equivalent to those granted by the Board of Trade. The last appendix gives the forms used in these examinations, and it will therefore be seen there is nothing omitted in giving the fullest information on the matter, and it would seem a candidate should be in possession of a copy, which may be readily purchased, the Government bookseller in London being Wyman & Sons, Ltd., Fetter-lane, E.C.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

CRANES are obviously a good field for the employment of electrical power, as thereby several units can be worked readily from the system without the drawbacks of small boilers and having to get up steam, with the attendant time wasted in doing so. There are defects in hydraulic installations for the purpose, and it is fairly clear a cable is superior to a water main. Assuming, then, the desirability of electrical means for the purpose in view, we may stop to consider that the load on a crane is intermittent and liable to heavy fluctuations. With such conditions it is advisable for the generators to be provided with large fly-wheels, and, if the plant is a small one, it is sometimes necessary to put in a storage battery. There are, as is well known, several motions in a crane for the different directions the load is conveyed, and sometimes two or three of these take place simultaneously. A separate motor should be fitted to each of these, and it is necessary that control of all these should be given from one position. The two types in common use are the jib and travelling, the former being employed where the radius of action is small, and this naturally comes cheaper than the other type. The hoisting motor is the most important, and is generally of special design. The direct-current series-motor is the class employed for the purpose, and by its use we know the speed depends on the load, and we thus obtain a large torque for a short period, which is a great advantage. For conveying the current to the travelling bridge, conductor shoes are generally employed to collect the current from a copper rod, the lead being into the operator's cabin, and branches through the controllers to the various motors desired. Reversing controllers are fitted and limit switches fixed to prevent the crane from attempting to exceed its normal speed. The hoisting motor requires some consideration as the brake must hold the winding gear under all conditions should, for instance, the supply fail. A slow speed is necessary for lowering as well as for hoisting. A special type of controller is necessary for this with different resistances, but to obtain a slow speed the weak field a reduction of current gives must be obviated, and this is done by placing resistance in parallel with the armature, and so making a stronger field with a reduction of voltage across the brushes. The braking of cranes is important, and usually when the current is on the brake is off, so that if supply fails the brake goes automatically into position to hold the load, a powerful hand brake being operated by an electro-magnet for the purpose.

Sparking is the principal trouble to be apprehended with motors, for which, of course, faulty designs may account in some measure, but there are other reasons also, one of which is a dirty or rough commutator. Another is a loose bar in the same detail. If the brushes are not set properly, with the proper amount of backward flow, sparking will result. Brushes, too, may not fit the commutator, and the pressure not be properly adjusted. Overloading is a common cause of sparking, and this may be due to a variety of causes, besides that of too much work. A damaged armature coil may be the source of the mischief, as every time the commutator bar comes under a brush it will cause sparking.

An interesting paper was read before the recent meeting of the British Association on turbines. This gave the present position of the subject, and showed that blowing engines on this principle have been constructed with success. In this the moving blades are set at an angle to the plane of revolution, and are much like a multi-bladed propeller. A turbo-blower has also been constructed for dealing with large volumes at low pressure, and the saving over the old type of blowers is reported as very large. As reciprocating engines cannot utilise a high vacuum as the steam turbine does, it is now said to be proposed to employ an exhaust turbine, and connect it to the ordinary engine for obtaining a better vacuum from which a large gain is anticipated. The system is to be tried shortly, and, instead of getting down to, say, 7 lb. absolute, as low as 1 lb. will be likely reached.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

THE actual booking of fresh orders by Clyde shipbuilders and engineers during August—or that portion of it which has passed at date of writing (the 25th—has not taxed their energies much, although, of course, alertness and activity have, as usual, been evinced in seeking for and cultivating fresh business. Like certain firms in other large centres, a number of them have good prospects of contracts soon "materialising," both for mercantile and naval work. The Admiralty have asked tenders from two firms for a share of the eight coastal destroyers forming a part of the new naval programme, and to submit with the tenders the designs they would suggest. The distribution of this work is being awaited with extra keen interest.

Clyde builders also hope to share in the long-talked-of important order for Brazilian warships to be placed with British shipbuilders. In this connection it may be noted that the designs of battleships and coast-defence vessels which were, some time ago, sent in to the Argentine Legation in London have now been forwarded to Buenos Ayres for consideration by the naval authorities of the Republic. Plans for the new mail steamers—nine in number, it is believed—necessitated by the new Australian Mail contract are now under consideration, and, after these are approved of, will be submitted to the Australian Government. Four or six of these vessels, it is stated, will be distributed between Messrs. Wm. Beardmore & Co. (Dalmuir), Messrs. Vickers, Sons & Maxim (Barrow-in-Furness), and at least two will be built by Messrs. Armstrong, Whitworth & Co., on the Tyne, and two by Sir Jas. Laing & Son (of Sunderland). The weekly payment of wages in Clyde shipbuilding and engineering establishments was inaugurated on August 4th. It will be remembered that the concession of weekly instead of fortnightly pays was only granted by the employers after several conferences. The objection of the masters was that the payment of wages weekly had an injurious effect on the time-keeping of a certain section of the workmen, and they have now made arrangements for keeping a careful record of the time-keeping of the workmen complained of. The various trade societies also have counselled their members to do all in their power to ensure even better time-keeping under the weekly pays system than there has been under the fortnightly pays. The Clyde Trustees, it may be added, are now also arranging to pay their large body of workmen engaged in the dock and other construction, dredging, &c., each week instead of fortnightly.

From inquiries made on August 13th at various Clyde shipbuilding yards, it was learned that on that day the resumption was a slight improvement upon an average Monday after a fortnightly pay. It is, however, too early yet to place much importance upon any comparisons regarding the time-keeping of the men under the weekly wage system.

Both the London and Glasgow Shipbuilding Co., Govan, and Messrs. D. & W. Henderson & Co., Ltd., Partick, whose yards are amongst the largest now remaining in the upper reaches of the Clyde, were to have launched a large vessel on August 16th, but, as it was considered unwise to take any risks of accident—the "launching run" in each case being practically in the same line, although from opposite sides of the river—Messrs. D. & W. Henderson & Co. decided to postpone launching their vessel until next day. Both efforts, almost as a matter of course, were satisfactorily carried through. The vessel launched from the London and Glasgow Company's works was the twin-screw steamer *Pampa*, for the Société Générale de Transports Maritimes à Vapeur, Marseilles, for their passenger and cargo service between the Mediterranean and South American ports. The dimensions of the vessel are: Length, 408 ft.; breadth, 47 ft. 5 in.; depth, 29 ft. 6 in. (moulded, to spar deck); and she measures about 4,600 tons gross. The steamer floated by Messrs. D. & W. Henderson was the *Oceana*, a vessel of 7,000-tons carrying capacity, for Messrs. Maclay & McIntyre, Glasgow. The new screw steamer *Arrino*, built by Messrs. Henderson for the Australian Steam Shipping Co. (Messrs. Trinder, Anderson & Co.,

London, managers), of 4,484 tons gross, recently carried out successful trials, a mean speed of about 14 knots having been easily attained.

As further showing the amount of new tonnage being completed at the present time on the Clyde, it is worthy of note that as many as four vessels were launched on the same day—August 21st—the names of which will be found elsewhere in these notes, and, of course, in the "Launches and Trial Trips" section of this issue. Previous to the 23rd, six vessels were consigned to their "native element," and subsequent to the date mentioned another six are expected to be put into the water, mostly all of them being vessels built in the yards of the upper reaches, viz., above Dumbarton. Of the lot, probably the most interesting is the *Irish Monarch*, the first vessel to be sent off the stocks of the new yard of Messrs. Napier & Miller, at Old Kirkpatrick, elsewhere referred to in these notes.

Messrs. A. & J. Inglis, Partick, are progressing with the construction of the King's new yacht. The vessel is to be called the *Alexandra*, in honour of the Queen, and is to cost £136,000.

Messrs. Mackie & Thomson, Govan, launched, on August 15th, the steam trawler *Macduff*, the eleventh vessel to be launched of an order for thirteen for the same owners—the Hellyers' Steam Fishing Company, Ltd., Hull.

Messrs. Alex. Stephen & Sons, Ltd., of Linthouse, who, as noted in last month's issue, have received an important order for a new mail steamer from the Allan line, have recently also been commissioned to build a large passenger and cargo steamer for Messrs. Cosulich Bros., of Trieste. The new vessel will be engaged in the firm's emigrant trade. In view of these new orders especially, the Linthouse firm are displaying their characteristic activity in launching the vessels they have on their stocks. Within the past two years, the firm have produced four vessels for the West African trade of Messrs. Elder, Dempster & Co., and on August 22nd, they launched an additional vessel for the same proprietary. This was the *Falaba*, for the Compagnie Belge, Maritime du Congo, branch of the Elder, Dempster proprietary, and sister ship to the *Albertville*, launched in May. These vessels, which have been designed with special adaptability to the West African trade, are all 4,500 tons gross, and have a speed of 15 knots.

Messrs. Fleming & Ferguson, Ltd., Paisley, have successfully carried through the speed and dredging trials of the twin-screw stern-well hopper dredger, recently launched to the order of the Timaru Harbour Board, New Zealand. The new vessel's dimensions are 224 ft. long, by 38 ft. broad, by 16 ft. deep, and she will carry 1,000 tons of dredged material in her hoppers. The vessel has been constructed under the superintendence of Messrs. John Macdonald & Son, York-street, Glasgow, Mr. George W. Linford, Glasgow, acting as resident inspector.

The new premises of Messrs. Yarrow & Co., situated at Scotstoun, on the north bank of the Clyde, is rapidly assuming shape, the structural work of the engineering and other shops being well in hand. Judging from the framework, these shops are to be lofty as well as spacious, a special feature connected with them—and with the tidal basin which is now under construction—being the lofty and circular railway for the electric cranes, transmitting items of machinery from the engineering and other shops to the quay alongside which vessels are to be outfitted when afloat. The works, it is anticipated, will be ready for the very fullest occupancy early in the year.

Messrs. Napier & Miller, Ltd., whose new yard at Old Kirkpatrick has now been in full swing for some little time, launched the first vessel from their new premises on August 22nd. This was the *Irish Monarch*, for the "Monarch" line of Messrs. Raeburn & Verel, Glasgow, to which line of steamers quite a number of additions have been made within the past two years, all of them built to the specification and under the superintendence of Captain John Black, the able marine superintendent for the firm named. It will be remembered that Messrs. Napier & Miller had to leave their yard at Yoker, at the end of last year, owing to the ground being required for the formation of the new Clydebank dock. The last vessel to leave the stocks was the *English Monarch*, for Messrs. Raeburn & Verel, and it is rather an interesting fact that the first vessel to be built at the new shipyard should also be for this firm. The shipbuilding firm have been in existence since 1898, and since then they have launched sixty-six vessels, of 109,000 tons. At present they are well supplied with work, the whole of their six berths being occupied the orders in hand including two steamers for Messrs. Wm. Burrell & Co., Glasgow, and two sailing ships for Messrs. Lever Bros., of Port Sunlight. The first sod of the new yard was cut on August 20th, last year, so that celerity indeed has characterised the work of laying out the premises, erecting workshops, &c. It was matter of remark at the launch of the *Irish Monarch* that there was scarcely any smoke being emitted from any part of the works. This always obtains, and the reason for it is that electricity for power as well as lighting has been adopted, and there is not even a generating station, where there is always to be found a little smoke, whether the motive power for generating the electricity be steam or producer gas. All the electricity is being supplied by the Clyde Valley Electric Supply Company, four miles away. The firm have tried to do everything to bring the works up-to-date, and, with the help of the Clyde Trust, who have straightened the river by cutting away a large slice of the foreshore, giving highly suitable launching water. The aim of Messrs. Napier & Miller is to build vessels 400 and 500 feet in length, but at a push—as Mr. H. M. Napier declared on the occasion of the first launch—the firm could "lay down a monster Cunarder." So far as the stability of the ground is concerned, the firm would not be afraid to lay down a battleship.

Mr. John G. Dunlop, of Clydebank shipyard, has been appointed a managing director of Messrs. John Brown & Co., of Clydebank and Sheffield, conjointly with Mr. Charles Ellis. Mr. Dunlop has been acting director at Clydebank since Messrs. Brown took over the works, but it is some eighteen years since he first held a position of responsibility in these well-known shipbuilding and engineering works, and he has during that time been identified with a long series of successes in merchant and naval shipbuilding.

Messrs. Wm. Denny & Bros., Leven Shipyard, Dumbarton, besides having received an order (as noted in August 1st issue) from the Union Steamship Company of New Zealand to construct a large turbine steamer for their Wellington-Lyttelton service, have also been instructed by the managing committee of the South-Eastern and Chatham Railway to construct for their Channel service two turbine steamers similar to the *Onward* and *Invicta*, delivered by the same builders last year. This, with other orders on hand, ensures a steady winter's work in Dumbarton.

Messrs. Caird & Co., Greenock, are to build for the Union Steamship Company of New Zealand a new steamer, 420 ft., by 53 ft., by 34 ft. She is intended for the company's intercolonial service, and will be fitted with triple-expansion engines capable of producing a speed of 16 knots loaded. Both she and the turbine steamer which the Messrs. Denny of Dumbarton will construct for the same company are to be ready in twelve months. Messrs. Caird & Co. launched on July 26th the screw steamer *Namur*, for the P. and O. Company, and this vessel had her engines and propellers tested in Victoria Harbour, Greenock, on the 22nd inst., prior to being tried for speed as usual. It is believed she will be ready for sea in the course of a week or ten days. The *Namur* is the second of four steamers contracted for by Messrs. Caird for the intermediate passenger and cargo service of this company. The *Nile* was launched in May, and the *Nyanza* and *Nore* are expected to be completed before the end of the year. Dimensions: Length, 450 ft.; breadth, 52 ft.; depth, 33 ft. 6 in.; gross tonnage, 6,600. The vessels are built to Lloyd's 100 A1 class, and are equipped with all the latest appliances for the rapid and efficient handling of cargo. Accommodation is provided for fifty-four first and forty second class passengers. The builders will supply quadruple-expansion engines.

Scott's Shipbuilding and Engineering Company, Ltd., Greenock, launched on August 6th a screw steamer of handsome model and yacht-like appearance, named the *Carparron*, which they have built for the lighthouse service of the Board of Trade in the Bahamas. This vessel performs the duty of lighthouse and lightship tender in the West Indies, similar to that performed by the steamers of the Trinity House for this country. This service is under the control of the harbour department of the Board of Trade, and is immediately superintended by Captain Frederick J. Lobb, R.N., Inspector of Imperial Lighthouses in the Bahamas, whose headquarters are at Nassau, and for whose use the new steamer is intended. Messrs. Biles, Gray & Co. designed the vessel, which is 185 ft. long; 29 ft. breadth (moulded); 14 ft. 6 in. depth (moulded) to upper deck. Above the upper deck is a long topgallant forecastle, and an open-sided shade deck, these together covering about three-fourths of the vessel's length.

Messrs. W. C. Martin & Co., electrical engineers, of West Campbell-street, Glasgow, and London—in addition to having on hand the electrical installation on board the Cunarder *Mauritania*, building by Messrs. Swan & Hunter, on the Tyne, which, it may be stated, is the largest installation of electrical lighting, power, heating, ventilating, bells, and telephones, ever fitted on board a steamship—have also the contracts to instal electric lighting and ventilating on the Anchor liner *California*, building by Messrs. D. & W. Henderson, Partick, and on board the two new Allan liners which are building respectively at Messrs. Barclay, Curle & Co.'s, Ltd., Whiteinch, and Messrs. Alexander Stephen & Sons, Ltd., Linthouse. Other work includes electric lighting and ventilating installations on board a steamer building by Messrs. Henderson, Partick; on board a steamer for the Howard Smith Co., building at Linthouse; for the five barges for the Suez Canal Company, building at Messrs. Lobnitz & Co.'s, Renfrew; and for a number of smaller vessels. In addition to these contracts, the firm who are to light the new Clydebank Dock for the Clyde Trust are providing their own current. These several contracts represent a volume of high-class business which has seldom, if ever, been equalled in the experience of any firm in a similar line.

The annual inspection by the Clyde Trustees of the Harbour of Glasgow and the River Clyde, with all the dock and quayage works in progress, will take place on September 4th, and is bound to be well attended. This is not only due to the fact that this will be the first inspection by the Trust as a body since its recent great enlargement, but is owing also to the fact that the various undertakings of the Trust are at a highly interesting stage. This applies to the new quayage at Merklands, below Partick, of which there is now completed 1,080 ft. out of the total 1,570 ft. It also applies to the work of constructing the Trust's new repair works and tidal dock at Renfrew; and, of course, in a very especial sense, to the immense new dock at Clydebank, and the construction and equipment of the surrounding extensive quayage and railway lying ground. Other features of interest, of course, are the work of removing Elderslie Rock, and of straightening the river at parts by cutting away slices of the present foreshores.

At Aberdeen, as well as at Govan, both of which are centres for the production of trawling and fishing craft, launching formed a feature of activity during the last week of August. Messrs. Hall, Russell & Co., of Footdee, Aberdeen, launched, on one day—the 22nd—and from the same slipway, three vessels of this description for Mr. Thomas Devlin, of Newhaven. At Govan, on the same day, Messrs. Mackie & Thomson launched two trawlers, built to the order of the Hellyers' Steam Fishing Company, Ltd., Hull,—for which company, as has already been noted, they launched a similar vessel on August 15th. All these vessels are practically of about the same dimensions, and, in the case of the vessels sent off the stocks at Govan, the engines will be supplied by Mr. W. V. V. Lidgerwood, of Coatbridge, the H.P. of each set of engines being estimated to give the vessel a speed of 9½ knots.

The Dundee Shipbuilding Company, Ltd., have secured an order from a South American firm for a steamer, 170 ft. in length of keel, intended to engage in the River Plate fruit trade.

The Commissioners of Northern Lighthouses are about to alter the character and increase the power of the light at Mull of Cantyre. While the work is in progress, a temporary light of the same character as the present light, viz., fixed white, but of less power, will be exhibited from the lighthouse buildings. The permanent light, when altered, will be group flashing white, showing two flashes every thirty seconds, with a power of about 281,000 candles, and it will be visible over the same bearings as the present light. It is expected that the alteration will be completed about the middle of October.

The extension of Kirkcaldy East Pier by 500 ft. continues to make satisfactory progress, some 300 ft. having been accomplished. It is probable that the Harbour Commissioners, who are now considering the matter, will decide to carry the extension out another 100 ft., or 600 ft. in all. Messrs. Brand & Sons, Glasgow, are the contractors for the work.

THE TYNE.

(From our Own Correspondent.)

Shipbuilding.—During the month the inquiries for cargo boats have been very few indeed, and such inquiries as have been forthcoming do not appear, so far as we can discover, to have led to any tangible results. It is understood that orders for three or four vessels for special services have been placed with some leading builders; but as this district depends largely on the cargo trade for the maintenance of briskness in the yards, the absence of demand for new cargo tonnage cannot but have a depressing effect.

The improvement that has manifested itself at Messrs. Armstrong & Whitworth's Elswick yard, is, under present circumstances, a thing to be noted, especially as the indications point to the realisation of a good winter's work at this establishment. We regret that appearances are not so good at the company's Low Walker yard, where there are now no less than three vacant berths. Messrs. Dobson & Co. have two vessels on the stocks, and at Messrs. Wood, Skinner & Co.'s establishment there are four vessels in progress. All the mid-Tyne graving docks are occupied with vessels undergoing more or less extensive repairs, and the Wallsend pontoons are also fully engaged.

Messrs. Swan, Hunter, & Wigham Richardson & Co., Limited, have seven vessels on the stocks, in addition to the Cunard express boat *Mauritania*, the constructional work of which is now almost as far adavnced as such work can well be previous to launching. There are several vessels being fitted out in the water, some of them being of superior class. Messrs. Hawthorn, Leslie, & Co., have their berths fully occupied, and the fine vessel *Port Augusta*, recently launched for Messrs. Milburn, is receiving her sea-going equipment of accessories in the river. The firm have opened offices in Queen-street, Newcastle, which will doubtless prove a convenience to clients wishing to have communication with the firm on matters of business pertaining to any of the departments. It is stated that the firm have lately received from a Russian company an order for two cargo boats of moderate size, and also an order for a powerful towing steamer, to be employed in the Port of Calcutta. Messrs. Robert Stephenson & Co. continue to have a good show of work in the yard, and the large graving dock is still occupied. There is also a vessel beside the quay receiving the requisite outfit for sea.

The Palmers' Company have completed the erection of another electrical hoisting structure, which covers two berths and is about double the length of the original structure, that is to say, about 1,000 ft. The two berths are now occupied with vessels in course of construction, and we gather that the work on these vessels is being executed with quite exceptional rapidity. Many different systems have been devised for minimising the labour employed in placing in position the sectional parts of ships while building; but that adopted by the Palmer Company seems to have an advantage over others in being simpler, more effective, and more economical. The company have just launched a vessel, and have one in the graving dock being repaired. The Commercial Dry Dock Company have also their two docks occupied with vessels undergoing extensive overhauls.

The Northumberland Shipbuilding Company launched a vessel on the 22nd inst., and have five others in various stages of progress. The machinery equipment of the establishment is receiving important additions, and the output capacity, which was already exceptionally large, will soon be increased to a very substantial extent. The Tyne Iron Shipbuilding Company have just placed the keel for a vessel in a recently vacated berth, and have two other boats in the framing and plating stages. Messrs. Readhead have a large vessel at the shearlegs receiving her machinery, and have the four berths of the shipyard occupied with vessels in course of framing or plating. Further down the river Messrs. Eltringham have a couple of boats on the stocks, and the Smiths' Dock Company have some half-dozen in hand. The graving docks are very generally occupied with vessels undergoing repairs, and in a few cases the repairs are more than ordinarily extensive.

Engineering.—The operative engineers have put in a claim for an advance of wages, although it is little better than half a year since they received an advance. To give the claim an appearance of reasonableness it ought to be shown that trade has further improved since then; but for our part we can see no evidence of improvement, but distinctly the reverse. The fact that one or two firms may have an abundance of work cannot be held to justify a change which

must affect *all* the firms, and it is a certainty that those firms who are usually engaged in the manufacture of engines for cargo boats, are not so well off for work now as they were in February last. These frequent claims for changes in wages rates are very unsettling to trade, and it is time that an agreement was arrived at that wages settlements should stand for at least twelve months without change. This arrangement would eventually prove advantageous to all parties, and would render unnecessary a good many of the "conferences," now held for no better purpose than wasting time. The employers have had a meeting and declined to give an advance.

The cross-Channel steamer *Berlin*, of Harwich, is now lying beside the St. Peter's Engine Works, receiving a complete equipment of new machinery, which must greatly increase her effectiveness as a passenger boat. There are several other good contracts in hand at these works, and the maintenance of a fair degree of briskness is assured for some time.

Messrs. George Robson & Co., Tyne Dock, have in hand some good contracts for new work, and are also busy in repairing. Messrs. Toomer & Co. are keeping well employed, and other engine-repairing works in the locality are doing moderately well. Iron foundries at Shields are very busy, and similar establishments at other centres on the river are still having a sufficiency of work. In the forges no material change is to be noted.

THE WEAR.

(*From our Own Correspondent.*)

Shipbuilding.—Messrs. Sir James Laing & Sons launched a large vessel from their central yard on the 21st inst., and commenced clearing the berth for another keel immediately, thus showing that they have plenty of work to go on with. They have at present four large vessels on the stocks—two in the plating, and two in the framing, stages—and they have still a good deal of repair work in hand. The firm have commenced the building of two vessels—each 575 ft. long—for employment in the new mail service to Australia. Messrs. R. Thompson & Sons and Messrs. Osbourne, Graham & Co., have also just launched vessels, and we are pleased to hear that in each case there is a keel to go in the vacated berth. Messrs. Doxford have their berths fully occupied, and though they are getting boats off the stocks with quite unequalled despatch, the impression exists that their order-book is still very full. Messrs. Short Brothers have a vessel ready for launching, and another well advanced, whilst two others are in the framing stage.

Messrs. Austin are now fitting out beside their yard the coal carrying steamer *Lady Cora Wright*, which was launched by them a few weeks ago, and is said to be one of the largest vessels that have yet been built for exclusive employment in the coal trade. The firm have still three vessels on the stocks, two of which are likely to be launched this year. They have a vessel in the graving dock undergoing repair, and one on the pontoon being painted, &c.

The Sunderland Shipbuilding Company have three vessels in hand, all of which are of large tonnage, and it is understood that as yet their orders are by no means exhausted. At Messrs. Bartram's there is a vessel being plated, and one in the framing stage, while in this case also, there is said to be other work in reserve. Messrs. Blumer have three vessels in hand, and at the North Sands Yard the five berths are fully occupied, the rule being for a long time past to place a new keel in position whenever a launch takes place.

Engineering.—A very important extension of premises is contemplated by Messrs. George Clark & Co., of the Southwick Engine Works, and already the sanction of the local authority has been applied for and obtained. This sanction was necessary owing to a proposed diversion of public roads, to carry out which, however, an order from a Quarter Sessions Court must still be obtained. With regard to the latter no difficulty is anticipated, and it is expected that the proposed extension will be commenced almost immediately. The British Insulation and Helsby Cables Company have commenced the laying down of electric cables on the north side of the Wear, with the view of supplying electric current for power purposes to shipbuilding and engineering firms who may require it. The company have, we understand, a power station on the Tyne, where they have numerous clients, and will, no doubt, make their new departure on the Wear a success.

Blyth.—The Blyth Shipbuilding Company continue to obtain a fair share of new work, and have just been successful in securing the contract to carry out extensive repairs to the ss. *Cervona*, which was badly damaged through being ashore in the St. Lawrence. The vessel had to be temporarily repaired to enable her to perform the voyage home. Coal shipments at this port are steadily increasing, and it is expected that the present year will prove to be a record one in this respect.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

THE Manchester Ship Canal revenue receipts for the half-year ending Midsummer amounted to £233,176, and the expenditure to £133,881, leaving a credit balance of £99,295. The profits on the Bridgewater department of the company were £18,258. With bankers' and general interest the total profit on the half-year's working was £119,030. Out of this sum the directors have paid interest upon the first and second mortgage debentures, £44,743; interest upon debenture stock, £3,497; interest upon the mortgage of surplus lands, £1,000; rent of transit shed, Dock No. 8, £3,130; rent of Dock No. 9, and transit sheds, £12,500; and the remainder £54,160, to the Manchester Corporation on account of interest on the debentures they hold.

The growth of the traffic on the Ship Canal has been steady and continuous. The increase in the weight of sea-borne merchandise amounted to 247,207 tons, as compared with the first half of the previous year. The receipts were greater by £24,432. The ordinary working expenditure was £5,432 larger, but it was considered judicious to provide £8,000 in respect of the accident to the Irlam locks, which may or may not be exceeded when the bill has to be paid.

The Bridgewater Canal traffic has improved. The profit for the half-year amounted to £18,258, against £14,701 in the corresponding six months.

The works required in order to permit of the level of the water in the estuary section of the Ship Canal being raised so as to give a minimum depth of 28 ft., are nearly completed, and the deepening of the Canal from Latchford to Manchester is progressing steadily. The new lay-by above Eastham, with dolphins for mooring vessels, is now completed. The insulated chamber in transit shed No. 2, with the requisite machinery, is being constructed for the sorting and delivery of frozen produce landed from the steamers. Additional railway sidings have been constructed at the north side of Dock N. 9, and at other points of the dock system. Small extensions of the sheds and quays of Nos. 3 and 4 docks are being carried out.

The Manchester Ship Canal Warehousing Company has now a credit balance to revenue account of £12,925. After payment of charges and interest on the preference shares there is a net balance of £6,123. An interim dividend at the rate of 6 per cent. per annum for the half-year ending December has already been paid, and the directors recommend another like dividend for the half-year just ended, leaving £463 to be carried forward. This balance, however, is subject to the payment of the directors' remuneration.

The Manchester Dock and Warehouse Extension Company, Limited, at its fifth general meeting, reported a balance to the credit of revenue account, after necessary deductions, of £13,313. A dividend of 5 per cent. for the year was declared. This leaves a balance to be carried forward of £813.

Mr. Onyon, of the firm of Messrs. Onyon, Lake, & Co., who has taken an interest for some years past with Manchester men in fostering direct shipments from New Zealand to Manchester and other West Coast ports of this country, is in close touch with Sir Joseph Ward, the new Premier of New Zealand, and it is expected his Government will shortly establish Government representation in Manchester for the North of England, in addition to their High Commissioner's offices and staff in Victoria-street, London.

There has been a falling off in the importation of American cotton to Manchester since the opening of the season on September 1st last, of 210,000 bales. Liverpool suffered a decrease of 779,000 bales. Last year the American crop was the largest on record, and prices fell considerably. On September 1st there was in Liverpool and at sea upwards of 400,000 bales more than on the same date in 1904.

Egyptian cotton arrivals here have offered a considerable contrast to American cotton. During the season the importation, up to date, has been 211,000 bales, an increase of 33,000 bales. The shipments to Liverpool and Manchester were 448,000 bales. As a rule a bale of Egyptian cotton is half as heavy again as an American bale.

Grain mills are increasing on the brinks of the Ship Canal. Flour and provender mills on Trafford Wharf are in full work. Another is to be opened this month (September), and a further provender mill is projected.

The Rochdale Canal accounts for the half-year allow a dividend of 10s. per cent., being 2s. 6d. more per cent. than for the corresponding dividend in 1905, and a larger balance is carried forward.

The timber trade in connection with the Manchester Ship Canal continues steady, with very little fluctuation in prices. Stock, in cubic feet, at the docks on August 1st was as follows: Hewn pitchpine, 6,500; sawn pitchpine, 301,000; pitchpine planks, 9,000; Quebec board pine, 150,000; birch logs, 36,000; birch planks, 129,000. Standards: Spruce deals, 15,100; pine deals, 2,390; Baltic deals, 6,840; Baltic flooring, 1,650; Galatz, &c., whitewood, 2,860; oak, Canadian, and U.S.A., 11,000 cubic feet.

Messrs. Samuel Smith & Co., London, and Messrs. Bagnall & Co., Limited, Manchester, and Mr. Frank H. Bagnall, Ship Canal Docks, have amalgamated. These firms were established originally about fifty years ago, and are practically two of the oldest in the oil trade in the country. Large additional works are to be carried out at the docks for the further development of the combination.

The Lord Mayor of Manchester had his eyes opened to the extent of the Corporation's Markets Committee's work at the Ship Canal on the 15th ult., by paying a visit to the foreign animals' wharf. He was astonished at the extent of it, and when he had seen all there was to see, he said what had been good for him would be good for each of the 124 members of the Council, which shows how little knowledge one department has of another department's work. We have previously given particulars of this branch of the city's undertaking. We may add that the ports from which cattle are shipped to Manchester are Montreal, Quebec, and St. John's (Canada); New York, Boston, and Philadelphia. In 1905, the number of cattle landed at the wharf was 30,639, against 28,859 in 1904, 24,081 in 1903, and 1,046 in 1896, the first year the wharf was in use.

A revised schedule of charges and regulations relating to cotton importations at the Manchester Docks has been issued by the Manchester Ship Canal Company, and will come into force to-day (September 1st). The only differences between this and the previous schedule are that through railway rates to Gargreave and Mansfield Woodhouse have been inserted; that the through railway rate to Goole, Grimsby, Hull, and New Holland has been increased from 17s. to 19s. per ton; and the rate to Tyldesley reduced from 10s. to 9s. 7d. per ton.

The iron trade in the County Palatine remains very firm. Prices of pig iron have gone up fully 1s. per ton during the month, for both English and Scotch metal. Manufactured iron and steel steady. Quotations are as follow:—Scotch metal: Eglington, 62s.; Dalmellington, 61s. 9d.; Glengarnock, 62s. 6d.; Gartsherrie, 64s. 6d., delivered at Manchester, 2s. 3d. less if delivered at Heysham, and 1s. less if landed at Preston. Lincolnshire pig iron No. 3, 57s., No. 4 forge 53s. 6d., delivered Manchester; Middlesbrough, 61s. 10d.; Derbyshire, 58s.; Staffordshire, 57s.; Lancashire, 61s. to 62s., delivered at Manchester; hematites (West Coast) 66s. f.o.b.; hematites (East Coast), 66s. f.o.t. Lancashire and Yorkshire bar makes, £7 5s.; steel angles, £6 12s. 6d.; sheets, £8 10s.; round steel bars, £7 5s.; boiler plates, £8 12s. 6d.; English joists, £6 10s.; hoops, £7 17s. 6d.; steel hoops, £7 15s.; wide flats, £6 17s. 6d.; tees, £7; channels, £7 5s. to £7 7s. 6d.; billets (English), £5 10s.; billets (foreign), £5 7s. 6d.; seamless copper tubes, 1s. per lb.; braised tubes, 11¾d. per lb.; seamless brass tubes, 9¾d. per lb.

The coal trade shows some improvement, not only in steam and forge coal, but, during the last week, in house qualities. After the increase of 5 per cent. in miners' wages in the North of England, and in South Wales, the Lancashire colliers expect shortly to be placed on a like footing. Average quotations are as follow—per ton at the pits: Best house coal, 13s. to 14s.; secondary, 12s. to 13s.; common, 9s. to 10s.; steam and forge, 8s. to 9s.; best engine fuel, 7s. 6d. to 8s. 6d.; best slack, 6s. 9d. to 7s. 6d.; medium, 6s. to 7s.; common, 5s. to 6s.; coal for shipping on the Manchester Canal, 9s. 6d. to 10s. 6d.; furnace coke (various), from 17s. to 34s.

THE THAMES.

(*From our Own Correspondent.*)

THE question of the Port of London difficulty is apparently by no means settled. The recent meeting of a committee to advise the Board of Trade on the matter found the wharfingers' interests a problem with which to cope. There is a large amount of capital involved in this direction, and a port trust of the docks might very seriously jeopardise these important interests. Meanwhile, the docks themselves are saddled with a great amount of suspense. We know of the dock war that arose lately, but one effect of recent exposures has been the reduction in the rates in the Poplar district which to large concerns will, of course, mean an advantage. Whatever the outcome may be, it seems to be agreed that any new port trust will have to pay its own way, and be independent of the inhabitants of Greater London, and this is as it should be.

Meantime, the meetings of the dock companies have been held, and we thus get the views of those most interested. The London and India Company do not present a very favourable report, as their gross earnings for the half-year were reduced by £33,138. A good deal of this was due to the low imports caused by the disturbed state of Russia. There seems, however, to be a turn in the tide as regards the volume of trade coming in the company's way, judging by the first month of the current half-year. Showing what a burden the rates are, the company have had to pay an increase of £32,000 extra in the short period of three years. It was estimated that property owners in the district who had no voice in the management of public funds accounted for 35 per cent. of the total ratable value, which, of course, is a large proportion.

Before adjourning for the recess, the London County Council decided to discontinue running a winter service of their steamboats on the river, but an amendment to discontinue the direct management of the boats was not carried. The boats will, therefore, be laid up, and such of the staff as are not needed discharged.

The question of the Australian mail contract, to which we have previously referred, has been further elucidated, and it now transpires that there are other builders in the syndicate than those we have mentioned. There are the firms of Beardmore, Vickers, and Armstrong, besides Sir Jas. Laing & Sons, whom we have already named. There is, however, a prominent firm of London shipbuilders included, in the firm of Birt, Potter & Hughes, Ltd., who have large Australian interests, and, presumably, this is the firm who will control the running of the vessels. New Zealand is said, also, to be interested in the contract, and, if so, it will be the first time that Australia and New Zealand have combined for the purposes of a mail service to this country. As we have said before, this matter does not affect the British Government contract with the P. & O. Co., and their weekly mail service. The Bill has been authorised by the Commonwealth Government by 28 votes to 3 in the House of Representatives.

The P. & O. Co. is about to lose the services of their chief general manager, Mr. Kendall, who has been thirty years with the company. This covers a long period, in which a great number of changes have been made, but the position of the company seems stronger than ever to-day.

The *Worcester* training ship for cadets had their annual prize-day recently, and the President of the Board of Trade was present. Sir Thos. Sutherland presided, and a rosy picture was drawn of the state of the mercantile marine and the premier position we hold in the world in this respect.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—It is an old adage that "everything comes to him that waits," and the same is likely to prove the fact as to shipbuilding orders at Barrow. No new business has been reported by Barrow builders for some time past, and the yards in the meantime are being rapidly emptied of work. Indeed, there is nothing on the stocks at Vickers, Sons & Maxim's

naval construction yard but a second cruiser for the Peruvian Government and a large armoured cruiser for the Russian Government. But the firm is much nearer to the booking of new orders than was the fact a month ago. It is understood that the firm will build two of the new fast Australian mail steamers, and the chances are that they will even build a third. For some time past, very little work for the mercantile marine has been done at Barrow. The Vickers firm has indeed laid itself out especially for naval construction for the British and other Powers, but, as experience has proved that this class of orders are not always available, and as there is a big staff at the Barraw yard, and the most complete resources it is possible to imagine, other work is required to dovetail in so as to maintain regularity of activity. During the past few years, although new orders have not been plentiful, the firm has been extending the yard in all directions, and have added from time to time new departments which have helped to make the yard more complete and self-resourceful. Further extensions are now in progress in the enlargement of the already very large shop available for the manufacture of gun-mountings. The new addition will be a very large one. It has been rendered necessary, first of all, by the very large demand for gun-mountings, and, secondly, because of the need which has arisen to put down new tools of up-to-date design in order to more effectually and more economically deal with these orders. The work of putting up this new extension has already commenced, and the orders are being given out for the new machinery required.

An agreement has been made between Vickers, Sons & Maxim and the Furness Railway Co. for the widening of the Buccleuch Dock passage-way from 80 ft. to 100 ft. It is estimated this will cost under £70,000, and the firm and the company have undertaken to pay half the cost each, but, should the cost exceed £35,000 apiece, Vickers will pay all over £70,000. Of course, the work of widening this passage-way is being undertaken in the interests of the Vickers firm, as they want to pass vessels through this water way up to 100 ft. in width to their new fitting-up berth in the Buccleuch Dock. This berth is well forward in construction, and already a massive 150-ton electric crane, with an immense flying jib, has been erected alongside. It is expected the berth will be ready for occupation in the course of twelve months, and that the widened dock entrance will also be completed by that time. It is important this work should proceed as quickly as possible, as it is expected one or two, if not more, of the largest battleships ever built will in the meantime be laid down in the Barrow yard. It is generally believed that important Russian orders will come to Barrow, and at present the Vickers firm are building a big cruiser for them.

The successful trial trip of the British cruiser *Natal* is referred to on another page. She is now receiving her finishing touches, and it is expected she will be handed over to the Admiralty in October or November.

The launch of the ice-breaker for the Canadian Government at Barrow was an interesting occasion, as she will probably be followed by other orders if it is shown she can fulfil the purpose of breaking up the ice in the River St. Lawrence and keeping an open sea-way in the winter months to the Canadian ports on that river.

Much activity is maintained in the work of building submarines at Barrow, but some disappointment was felt here when it was announced that the British Government had determined to build a portion of the submarines embraced in this year's construction programme at Portsmouth. There are, of course, chances of foreign orders for these very interesting and successful vessels.

Shipbuilding Materials.—The demand for shipbuilding material is rather better than it has been of late, and the mills are now working full time. It is expected new orders of some moment will be coming to hand shortly from other parts of the country, and there is almost a certainty of important local orders being placed with local firms at an early date. Heavy ship plates are at £7 5s. per ton. Steel castings are quiet, but there are prospects of improvement in this trade.

Hematites.—The hematite iron market has brightened up wonderfully, and the demand is steady at 66s. 9d. per ton net cash sellers. Stocks steady at about 71,000 tons.

Shipping.—Shipping is busier, and the exports of iron and steel this year have exceeded half a million tons, being practically the same as in the corresponding period of last year.

BELFAST.

(*From our Own Correspondent.*)

IN last month's "Notes" the hope was expressed that some of the inquiries that had come Belfast way would result in business. The hope has been fulfilled, several important orders having been booked within the past few weeks.

The Holland-American Line has contracted with Messrs. Harland & Wolff for the construction of a twin-screw liner of 23,000 gross tonnage. The vessel is to be 650 ft. long, and 77 ft. beam, and will be delivered in 1908. They are also said to have secured the order for one of the fleet of new steamers about to be built for the Brazilian Lloyd Company. It was reported that the Hamburg-American Line had placed an order with Messrs. Harland & Wolff for a vessel to exceed in size the new Cunarders *Lusitania* and *Mauritania*. This report was, however, contradicted by the Hamburg-American Company. Possibly our Teutonic neighbours may eventually attempt to improve upon these vessels, but, in the meantime, they will likely wait and see how the British fliers perform. On August 16th the twin-screw liner *Oronso*, built at the Queen's Island for the Pacific Steam Navigation Company had a satisfactory trial in Belfast Lough. The dimensions of the *Oronso* are:—Length, 465 ft.; beam, 56 ft.; depth, 40 ft.; and gross tonnage, about 8,000. The engines are of quadruple-expansion type. Handsome accommodation has been provided for about 200 first-class passengers, and there is also most comfortable accommodation for about 700 second and third-class passengers. The *Oronso* is a sister-ship fo the *Ortega*, which left Messrs. Harland & Wolff's hands in June, and she is the twelfth ship built by them for the Pacific Company. There is still a considerable amount of fresh tonnage to be put in the water from the Queen's Island before the close of the year, including the leviathan White Star Liner *Adriatic*, which is rapidly nearing the launching stage. The repairs to the International Navigation Company's *Haverford* are now nearly completed, and the vessel will have sailed before these "Notes" are in print. Messrs. Harland & Wolff have bought from the Admiralty the *Jackal*, which they are fitting out as a tug. She will be a very capable boat for towing purposes, having been built originally for the well-known firm of tow-boat owners, Messrs. W. & T. Joliffe of Liverpool. The vessel has been dry-docked here and found to be in very good condition. Several Queen's Island-built ships have changed hands within the past few weeks. The iron barque *Belfast*, built in 1874, and owned by the Shaw Savill and Albion Line, has been sold to South American owners for £4,000. The old White Star Liners *Coptic* and *Doric*, built in 1881 and 1883 respectively, have been bought by the Pacific Mail Steamship Company, San Francisco. And the Hamburg-American liner *Allemannia* has been acquired by the Russian Volunteer Fleet for about £45,000. The *Allemannia* was originally the *Orellana*, built by Messrs. Harland & Wolff for the Pacific Steam Navigation Company in 1893.

Work has been somewhat slack in Messrs. Workman, Clark & Co.'s south yard, though business has been brisk in the north yard. This firm has secured two of the larger vessels required by the Brazilian Lloyd Company. One of these steamers will be 320 ft. and the other 340 ft. long. On August 23rd they launched from their north yard a fine new steamer named *Star of Japan*, which they have constructed to the order of Messrs. J. P. Corry & Co. of London. It is interesting to note that the entire Star Line fleet of seven steamers has been built by Messrs. Workman, Clark & Company. This firm has six large steamers on the stocks at present, including one for the Ulster Steamship Company, to be named *Howth Head*. In the way of repairs they have the steamer *Ixion* in graving dock.

The question of constructing a wet dock at the head of the Musgrave Channel was brought up at a recent meeting of the Harbour Board, but it was shelved indefinitely, the majority of the Commissioners being of the opinion that it would be injudicious to entertain the idea of further capital outlay in this direction, while they were bound to the enormous cost of the new graving dock.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

San Cristobal.—On July 20th there was launched at Newcastle-on-Tyne, for Messrs. S. Pearson & Son, Ltd., an oil carrying trunk steamer, 258ft. long, 46ft. beam, and 18ft. 3in. depth (moulded). The vessel will have carrying capacity of nearly 3,000 tons on a light draught, and is built to 100 A1 class and Suez Canal Regulations to carry petroleum, or its products, in bulk. She has two powerful pumps, steam windlass, winches, and steering gear, and an electric light installation, including projector. The engines are being constructed by the Wallsend Slipway and Engineering Co., Ltd., the cylinders being 20½ in., 33 in., and 54 in. in diameter respectively, with a stroke of 36 in., steam being supplied at a pressure of 180 lb. per square inch by three single-ended boilers, designed to burn oil-fuel or coal as circumstances may require. The vessel is being supervised during construction by Messrs. Flannery, Baggallay & Johnson, of London, Liverpool, and Rotterdam.

Comtesse de Flandre.—On July 21st there was launched at Walker-on-Tyne another steamer for the Ocean Société Anonyme Belge d'Armement et de Navigation, the managers of which are Messrs. L. Dens & Co., Antwerp. The dimensions of the steamer are: 280 ft. by 42 ft. by 28 ft. 7 in., with shelter deck. Eight steam winches and all the latest appliances and ventilation are being fitted. The engines, having cylinders 22 in., 37 in., and 61 in., by 39 in., are being supplied by The North Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne. As the vessel left the ways she was named *Comtesse de Flandre* by Mrs. Henry J. Dobson, acting on behalf of H.R.H. the Comtesse de Flandre.

Kolpino. On July 23rd there was launched at Hull the steamer *Kolpino*, of the following dimensions: 300 ft. in length, 10 ft. beam, and 20 ft. 11 in. in depth. She has been built to British Corporation highest class, and specially strengthened to withstand the severe wear and tear due to the large quantities of ice encountered in the upper Baltic at the opening and closing of the navigation. The vessel will be propelled by triple expansion engines, steam being supplied by two large steel boilers, designed to drive her at a good speed on a minimum coal consumption.

Kildale.—On July 25th there was launched on the Wear a large cargo steamer named *Kildale*, of the following dimensions: Length, 361 ft.; beam, 46 ft.; and depth, 23 ft. The propelling machinery is of the triple-expansion type, having cylinders 24 in., 40 in., and 67 in. in diameter, with a stroke of 45 in., steam being supplied by two boilers, which will be fitted with forced draught. The vessel and her machinery have been built under the supervision of Messrs. Flannery & Given.

Nera.—On July 25th Messrs. J. Scarr & Son launched from their Beverley yard a steel barge, being the fourth of an order for six, built for Messrs. Joseph Rank, Limited, of London. The vessel, which was named *Nera*, has a carrying capacity of 170 tons, and is of the following dimensions: Length, 70 ft.; beam, 20 ft.; depth, 8 ft.

Tredegar Hall.—On July 26th Messrs. William Doxford & Sons, Limited, launched from their yard the fourth turret steamer built to the order of the Cardiff "Hall" Line, of which Messrs. Edward Nicholl & Co. are the managing owners. The dimensions of the vessel are: Length, 342 ft.; breadth, 46½ ft.; and depth (moulded), 27½ ft.; and she is similar in other respects to her three sister ships afloat. The engines and boilers are also supplied by Messrs. Doxford. The naming of the vessel *Tredegar Hall* was gracefully performed by Miss Gwennie Nicholl of Cardiff.

Harpenden. On August 2nd the large steamer *Harpenden* was launched from the Middleton shipyard of Messrs. Furness, Withy & Co., Limited, Hartlepool. She has been built to the order of Messrs. J. & C. Harrison, Limited, 66, Mark-lane, London, E.C., and is over 357 ft. in length. The vessel is classed 100 A1 at Lloyd's, has large measurement capacity with clear holds; large hatchways and shifting boards will be fitted throughout; she will have seven large steam winches, donkey boiler to German law and Hamburg Police requirements, steam and hand steering gear, direct steam patent windlass, cellular double bottom all fore and aft, with after peak also available for water ballast. Accommodation is arranged on the bridge deck for the master and officers, and the crew in the forecastle. Triple-expansion engines by Richardsons, Westgarth & Co., Limited, Hartlepool, cylinders, 24 in., 39 in., 66 in. by 45-in. piston-stroke, and two single-ended boilers 16 ft. diameter by 10 ft. 9 in. long, working at a pressure of 180 lb. per square inch. The vessel was gracefully christened *Harpenden* by Miss Ethel Withy, Brantford House, West Hartlepool.

King Idwal.—On August 2nd there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields, a steel screw steamer built to the order of the King Line, Ltd. (Messrs. Philipps, Philipps & Co., London, managers), named the *King Idwal*. The vessel is 363 ft. in length by 50 ft. broad, by 25 ft. 9 in. depth (moulded), and is of the single-deck type, with girder framing and large clear holds, having poop, long bridge, and top-gallant forecastle, with double bottom all fore and aft for water ballast, water ballast being also carried in the fore and after peaks. There are deckhouses on the bridge for captain, and state-rooms, and also for the accommodation of engineers and officers, and a large house for apprentices under the bridge, the crew being berthed in the top-gallant forecastle. A centre bulkhead is fitted all fore and aft in the holds, with wood shifting-boards at the hatchways for the carriage of grain cargoes. The vessel, which has a complete outfit of winches and derricks, with a large horizontal multitubular donkey boiler for the rapid loading and discharging of cargo, has been built to Lloyd's highest class under special survey. She has been constructed under the supervision of Mr. W. B. Cumming and Mr. Douglas on behalf of the owners. The machinery and boilers are also constructed by Messrs. John Readhead & Sons, having cylinders 25 in., 41 in., and 67 in., with 45-in. stroke, steam being supplied by two large steel boilers working at a pressure of 180 lb. per square inch.

Ripon.—On August 3rd Messrs. Irvine's Shipbuilding and Dry Dock Co., Ltd., West Hartlepool, launched from their shipyard a finely modelled steel screw steamer, built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool. She is of the following dimensions: 336 ft. by 47 ft., by 24 ft. 10 in. The vessel is built to Lloyd's highest class, under special survey, and is of the single-deck type, having poop, bridge, and topgallant forecastle. A double bottom is fitted throughout on the cellular principle, and the fore and after tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stringers, giving clear holds for the storing of bulky cargoes. Five water-tight bulkheads divide the holds into six water-tight compartments, and wood grain divisions are fitted in the holds. She also has extra large cargo hatches, five steam winches (which are supplied with steam from a vertical multitubular donkey boiler), and is replete with all the latest improvements for rapid loading and discharging. A powerful quick-warping steam windlass is fitted forward for the working of the cables, and steam-steering gear is fitted amidships, with hand-screw gear aft. Accommodation for captain and officers is provided in poop, and that for engineers is arranged in houses on the bridge, and the seamen and firemen under topgallant forecastle. The sanitary, ventilating, and lighting arrangements have received special attention, and have been effected on the most approved lines. Engines of the triple-expansion type are being supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 24 in., 38 in., and 64 in., by 42 in., and two large single-ended boilers, 160 lb. pressure. The christening ceremony was gracefully performed by Mrs. Boyd-Carpenter, wife of the Bishop of Ripon, who named the vessel *Ripon* as she left the ways. There was a large company present to witness the launch, including Sir Christopher and Lady Furness, the Misses Boyd-Carpenter, Lady Brunton, Mr. and Mrs. S. W. Furness, Mr. Marmaduke Furness, J.P., Mr. and Mrs. H. Withy, Mr. R. W. Vick, J.P., Mr. A. S. Purdon, J.P., and Mr. J. T. Harris.

King Howel.—On August 3rd there was launched on the Tyne, to the order of the King Line, Ltd. (managers, Philipps, Philipps & Co., London), the steamship *King Howel*, which is of the following dimensions: Length, 365 ft.; breadth, 50 ft.; depth (moulded), 30 ft. 2 in.; has been built to the three deck rule, and will take the highest class in Lloyd's Registry. She has a deadweight capacity of 7,200 tons on a moderate draught. The engines are being supplied by Messrs. Palmer's Shipbuilding and Iron Co., Ltd., Jarrow, who are also supplying the boilers, and will

be of sufficient power to drive the vessel at a sea-speed of about 9½ knots.

Barrington Court.—On August 4th there was launched at Jarrow, by Palmer's Shipbuilding and Iron Co., Ltd., the screw steamer *Barrington Court*, built to the order of the Court Line, Ltd., of London. Her dimensions are: Length (between perpendiculars), 355 ft.; breadth (extreme), 50 ft.; and depth (moulded), 30 ft. 2 in. The vessel is of the single-deck type, and is constructed of steel, under the special survey of Lloyd's Register, to class 100 A1. She will be rigged as a two-masted fore-and-aft schooner, having telescopic topmasts to suit the Manchester Canal bridges. Ample water ballast is provided in a cellular bottom, extending all fore and aft, and also in fore and after tanks. The vessel is fitted with direct steam windlass on forecastle deck, steam-steering gear, and a substantial hand-screw steering gear aft. A complete equipment of steam winches and derricks is provided for the rapid manipulation of grain, coal, and general cargoes. The vessel is designed to load over 7,000 tons deadweight on a moderate draught of water, and she will be fitted with triple-expansion engines, having cylinders 26 in., 43 in., and 70 in. in diameter, by 45-in. stroke, with two single-ended boilers, 180 lb. working pressure. She also has a large donkey boiler, 100 lb. working pressure, for driving the steam winches, &c. The vessel was named *Barrington Court* by Mrs. Philipps, wife of Mr. Laurence Philipps, one of the directors of the Court Line.

Lady Cory-Wright.—On August 4th there was launched from the shipbuilding and repairing establishment of Messrs. S. P. Austin & Son, Ltd., Sunderland, the steel screw steamer *Lady Cory-Wright*, which has been built to the order of Messrs. Wm. Cory & Son, Ltd., London, E.C., and is the seventeenth vessel constructed by them for the same owners. Her dimensions are:—Length (between perpendiculars), 310 ft.; breadth (extreme), 44 ft.; depth (moulded), 22 ft. 10 in.; single-deck type, large hatchways specially adapted for the owners' coal trade, and fitted with every appliance for quick loading and discharging. The deadweight capacity will be about 4,000 tons on a light draught of water. She will be classed 100 A1 in Lloyd's Register, under special survey, and will have ample water ballast capacity so that the vessel may be able to make good passages in all kinds of weather. Accommodation for captain and officers is fitted in the poop, and for engineers in bridge, and crew in forecastle. The machinery is of large power, and supplied by Messrs. George Clark, Ltd., Southwick Engine Works, Sunderland, and the auxiliary machinery is by other first-class makers. Wailes, Dove & Co.'s bitumastic enamels were applied to the bunkers, and their patent bitumastic covering to the tank top in boiler-room. The construction has been superintended by Mr. Sydney Alder, on behalf of the owners, and the launch was successfully carried out in the presence of a number of friends, the naming ceremony being gracefully done by Mrs. Herbert Radford, wife of one of the directors of Messrs. Wm. Cory & Son, Ltd.

Fornebo.—On August 7th, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough, a steamer built with cantilever frames on Harroway & Dixon's, John Priestman's, and Livingston & Sanderson's patents, to the order of Messrs. Farnley & Eger, of Christiania. She is built to the rules of Norwegian Veritas for their highest class, her leading dimensions being 372 ft., by 52 ft., by 28 ft. 4 in. (moulded), and she will carry a deadweight cargo of over 7,200 tons on a light draught, with exceptionally large hatchways, 30 ft. wide, and perfectly self-trimming and unobstructed holds. The vessel will be equipped with ten powerful steam winches, ten derrick posts, warping capstan aft, hand and steam steering gear, and will have eight hatchways, six water-tight bulkheads, four boats, &c., and all the latest and most modern appliances for the rapid handling of cargo. In addition to this, the vessel will carry an unusually large quantity of water ballast located under the deck between the sloping sides of the holds, and the shell on each side of the vessel as well as in the double bottom and fore and aft peaks, thus making her an ideal ship when in ballast trim, with great steadiness at sea, increased speed, and the racing of propeller reduced to a minimum. She will be fitted with engines by the North Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 26 in., 42 in., 70 in., by 48-in. stroke, supplied with steam by three large single-ended boilers working at 180 lb. pressure, and fitted with Howden's system of forced draught. Her engines will be placed right aft. On leaving the ways, she was gracefully named *Fornebo* by Miss Bodin, the youngest daughter of Mr. Lauritz M. Bodin, the principal surveyor in this country to Norwegian Veritas.

King George.—On August 7th, Messrs. R. Craggs & Sons, Ltd., launched, from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer of the strengthened spar-deck type, 362 ft. long, 49 ft. beam, 28 ft. 5 in. depth (moulded). This vessel is being built under special survey to take the highest class at Lloyd's. Accommodation is provided for captain, officers, and engineers in spacious deckhouses on bridge, and for the crew in a roomy forecastle. Cellular double bottom is fitted throughout for water ballast, which is also carried in after peak tank. Eight powerful steam winches are provided of the most approved type, double derricks at all main hatches, steam-steering gear is supplied, and improved quick-warping steam windlass is fitted forward. The arrangements for handling ship and cargo are most complete in every respect. The machinery will be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, and will have cylinders 25 in., 41 in., 67 in., by 45-in. stroke, steam being supplied by three large single-ended boilers working at 180 lb. pressure to the square inch. The vessel has been built to the order of the Glasgow King Shipping Co., Ltd. (Messrs. John A. Walker & Co., Glasgow, managers), and, on leaving the ways, was named *King George* by Mrs. Burnett, of Arbroath. The specifications have been supervised, and the construction of hull and machinery inspected by Mr. W. Evitt, of Glasgow, assisted by Mr. J. McDonald, as resident surveyor.

Hirose.—On August 8th there was launched at North Shields, for Messrs. Neale & West, of Cardiff, a steel ketch-rigged steamer of about 230 tons, named *Hirose*.

Diadem.—On August 18th, Messrs. Richardson, Duck & Co. launched from their yard, at Stockton-on-Tees, a steel screw steamer of the following dimensions: Length overall, 361 ft.; breadth (extreme), 50 ft.; depth (moulded), 25 ft. 9 in.; gross tonnage, about 3,750. This vessel, which has been built to the order of Messrs. Hall Bros., of Newcastle-on-Tyne, will class 100 A1 in Lloyd's Register, and has been built under special survey. She is built to the three-deck rule, with one deck laid, and has cargo poop, bridge, and topgallant forecastle. Captain and officers are berthed in cabins on bridge deck, engineers in sidehouses on after end of bridge, and crew in topgallant forecastle. A cellular double bottom throughout and after peak tank are fitted for water ballast, and equipment includes six steam winches, large horizontal multitubular donkey boiler, steam-steering gear, &c. The engines, by Messrs. Blair & Co., Ltd., have cylinders 25 in., 41 in., 67 in., by 45-in. stroke, steam being supplied by two single-ended boilers having a working pressure of 180 lb. Wailes, Dove & Co.'s bitumastic enamel has been applied to bunkers and boiler-room tank, and bitumastic covering to boiler-room tank top. As the vessel left the ways she was christened *Diadem* by the Hon. Mrs. Garforth. The vessel has been built under the superintendence of Captain Wm. Lowrie, owners' superintendent.

Cedargrove.—On August 20th there was launched from the Southwick yard of Messrs. Robert Thompson & Sons, Limited, a single-deck steamer, built to the order of Messrs. Alexander and Arthurs, of Glasgow. Her principal dimensions are:—Length (between perpendiculars), 299 ft.; breadth, 44 ft. 6 in.; depth (moulded), 22 ft. 3 in. She is classed 100 A1 at Lloyd's, and is built on the deep frame principle, with one deck, leaving the holds clear of all obstructions, and the erections are, poop 25 ft., bridge, 74 ft., both being available for cargo if required, and topgallant forecastle for the accommodation of petty officers and crew, large and spacious deckhouses on top of bridge-deck for captain, officers, and engineers, the saloon being fitted up in polished oak. There are four large hatchways, each worked by a powerful steam winch for the rapid loading and discharging of cargo, with multitubular donkey boiler, quick-warping steam windlass, and steam-steering gear. The engines are by Messrs. George Clark, Limited, of Sunderland, of the triple-expansion type, having cylinders 21½ in., 36 in., and 59 in. by 39-in. stroke, with extra large boilers of 180 lb. pressure. During construction the ship and her machinery have been personally superintended by Mr. George Jaques, of Newcastle-on-Tyne. As the vessel left the ways she was gracefully christened *Cedargrove* by Mrs. Alexander, wife of one of the managing owners.

Holywood.—On August 20th Messrs. Osbourne, Graham & Co., launched from their yard at Hylton, Sunderland, the steel screw steamer *Holywood*, which they have specially constructed for the well-known trade of William France, Fenwick & Co., Limited, of Sunderland and London, and which is the third vessel of this type constructed for this firm. She is built on the self-trimming principle, and carries 3,100 tons on a shallow draught, and has been constructed to take Lloyd's highest class. The accommodation for the officers has been fitted up in the poop, the cabins, saloon, and messroom being tastefully fitted out in hardwood. The engineers' accommodation is fitted around the engine and boiler casing, under the after end of the bridge. The vessel is equipped with the most modern appliances for economical working of cargo, the winches, steam windlass, and donkey boiler all being supplied by Messrs. Clarke, Chapman & Co., Limited, of Gateshead, and steering gear by Messrs. Lynn & Co., Limited, of Sunderland. As the vessel left the ways she was gracefully christened by Miss Squance, daughter of Captain Squance, of the firm of Messrs. Squance & Ingram, under whose supervision the hull has been constructed. After the launch the vessel was taken to the North Eastern Marine Engineering Works, Sunderland, to receive her engines, which have cylinders 20½ in., 33 in., 54 in. by 39-in. stroke, with two large boilers working at a pressure of 180 lb. The machinery has been constructed under the superintendence of Messrs. Thompson & Eyres, of Sunderland.

Cygnus.—On August 21st Messrs. Wood, Skinner & Co., Limited, launched from their shipbuilding yard at Bill Quay-on-Tyne, a new steel screw steamer, which has been built by them to the order of Mr. Conrad Blumer Hofgaard, of Christiania, Norway. She is of the single-deck type, with short poop, long bridge, and topgallant forecastle, and has accommodation for captain, spare berths, &c., in deckhouse on bridge deck, the officers and engineers being berthed in sidehouses and the crew in the topgallant forecastle. Water ballast is provided in the cellular double bottom, all fore and aft, and in the after peak tank. The vessel will be rigged as a two masted schooner and will be fitted with every improvement and appliance for the rapid loading and discharging of cargo. The machinery, which is of the improved triple-expansion type, has been constructed, and will be fitted by Messrs. The North Eastern Marine Engineering Company, Limited, of Wallsend. Both the ship and engines have been built to Norske Veritas requirements for their highest classification and under the special survey of Mr. Lauritz M. Bodin, of Sunderland, the local representative of that society, and have also been superintended during construction by Mr. J. Houston, of Sunderland. The launch was in every way successful, and as the vessel left the ways she was gracefully christened *Cygnus* by Miss Lizzie Houston, daughter of Mr. J. Houston, superintendent for the owner.

Denewell.—On August 21st there was launched from the yard of the Tyne Iron Shipbuilding Company, Limited, of Willington, Quay-on-Tyne, a steel screw steamer, built to the order of Mess. G. N. Patterson & Co., of Newcastle-on-Tyne, and of the following dimensions:—Length, 331 ft.; breadth, 48 ft.; depth (moulded) 24 ft. 4½ in., and to Class 100 A1 at Lloyd's, on the single-deck rule. The vessel has water ballast, fitted on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including six double-cylindered steam winches, direct-acting steam windlass, large donkey, steam-steering gear, by Messrs. John Lynn & Co., Limited, of Sunderland, and Hastie's screw gear aft. The engines which are to be supplied by Messrs. The Wallsend Slipway and Engineering Company, Limited, of Wallsend-on-Tyne, are of the triple expansion type, having cylinders 23½in., 39½ in., and 65 in. by 42-in. stroke, and working at a pressure of 180 lb. On leaving the ways the vessel was named *Denewell* by Miss Minnie Patterson, daughter of the owner.

Harlyn.—On August 21st Messrs. William Gray & Co., Limited, launched at West Hartlepool the handsome steel screw steamer *Harlyn*, which they have built to the order of Messrs. J. & C. Harrison, Limited, London. She will take the highest class in Lloyd's, and is of the following dimensions: Length overall, 353 ft. 6 in.; breadth, 49 ft. 6 in.; and depth, 25 ft. 2 in., with complete shelter deck. The saloon, state-rooms, captain's, officers', and engineers' rooms, &c., will be fitted up in the houses on the shelter deck and the crew's berths in forecastle. The hull is built with deep frames, clear holds, cellular double- bottom, and aft-peak ballast tank, seven steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on beams overhead, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25½ in., 40½ in., and 67 in. diameter, with a piston stroke of 45 in., and two large steel boilers for a working pressure of 180 lb. per square inch. The ship and machinery have been built under the superintendence of Mr. J. E. Caiger, on behalf of the owners, and the ceremony of naming the *Harlyn* was gracefully performed by Mrs. John Harrison, of London.

Wangard.—On August 22nd an important launch took place from the yard of the Northumberland Shipbuilding Company, Ltd., the vessel being a finely moulded steamer, built to the order of Messrs. the Midgard Deutsche Seeverkehrs Aktiengesellschaft, of Bremen, it being the third vessel built by the Northumberland Shipbuilding Company, Limited, for this company, who have two other vessels at present building for the same owners. The vessel is 372 ft. overall by 48 ft. beam extreme by 30 ft. 10 in. depth (moulded), and has been built under special survey to the highest class at Lloyd's spar deck rule, with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation, which is very ample, being all placed in steel houses on the bridge deck. The 'tween decks are lofty, and so arranged that cattle, troops, or emigrants may be carried if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes has been arranged for, consisting of eight steam winches by Messrs. Clarke, Chapman & Co., Limited, Gateshead-on-Tyne, a large number of cargo derricks, steam-steering gear, by Messrs. Hastie & Co., Greenock, and steam windlass by Messrs. Emerson, Walker & Thompson Brothers. She is, of course, fitted with the usual water ballast arrangements for light passages. The vessel is designed to carry about 7,300 tons dead weight on a draught of 25 ft. ½ in., and to steam about 10 knots loaded at sea. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Limited, Sunderland, the engines having cylinders 25 in., 41 in., and 69 in. by 48-in. stroke, with three large steel boilers 14 ft. by 10 ft. 9 in., 180 lb. working pressure.

Achilles.—On August 22nd there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 117 ft., by 22 ft., by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Messrs. The Consolidated Steam Fishing and Ice Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Achilles* by Miss Marsden, of Grimsby, after which the company adjourned to the builders' offices, where cake and wine was served, and the customary toasts given and responded to.

Goslar.—On August 22nd a fine steel screw steamer was launched from the Neptune Shipyard of Swan, Hunter & Wigham Richardson, Ltd. The steamer, which is being constructed to the order of the Deutsch-Australische D. G., of Hamburg, is 394 ft. in length, by 52 ft. broad, and will carry over 7,000 tons deadweight on a light draught of water. She has long poop and bridge combined, and is being constructed to obtain the highest class in Lloyd's Register. The propelling machinery, which is also being constructed at the Neptune Works, is designed for a speed of 12 knots, and consists of a set of quadruple-expansion engines, on the Yarrow, Schlick, & Tweedy system, supplied with steam from three single-ended boilers. The appliances for working the ship and loading and discharging her cargo are of the most modern and approved description, including steam windlass, eleven steam winches, electric lighting, &c. As the vessel left the ways she was named the *Goslar*.

Countess Warwick.—On August 23rd the Cardiff firm of Messrs. Williams & Mordey had launched for them, by Messrs. William Doxford & Sons, Ltd., Pallion, Sunderland, a large finely modelled turret steamer, designed for general cargo carrying. The principal dimensions are as follows: Length, 365 ft.; breadth, 51 ft.; moulded depth, 27 ft. 6 in. The vessel will carry 7,000 tons on the light draught of 22 ft. 6 in. She has the very large capacity of 400,000 cubic

feet, combined with very low registers, which will make her a very economical carrier. The engines and boilers, also built by Messrs. Doxford, are as follows: Engines, with cylinders, 26 in., 42 in., 68 in., by 42-in. stroke; and two boilers, 16 ft. 6 in., by 11 ft. 3 in., will give the vessel a speed of 9½ knots fully loaded. She is fitted with double derricks and all the latest appliances for the rapid handling of cargo. As the vessel left the ways she was gracefully named *Countess Warwick* by Mrs. Williams, wife of one of the managing owners. The vessel has been built under the personal superintendence of Mr. Mordey, one of the partners. After the launch the company adjourned to Messrs. Doxford's offices. Mr. Charles Doxford, in the absence of Sir Theodore Doxford, who is away on the Continent, proposed success to the vessel, and in doing so presented Mrs. Williams with a diamond and pearl necklace and pendant, in commemoration of the occasion. Mr. Williams, on behalf of the managing owners, thanked Messrs. Doxford, and said they were very pleased with the ship which they had just seen launched. She had been purchased at the lowest point of the market, and he felt confident that she would be a very profitable vessel for his shareholders.

Ladysmith.—On August 23rd there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 128 ft. 4 in., by 22 ft., by 11 ft. 6 in. depth of hold. The vessel has been built to the order of Messrs. Bernstein, Staff & Taylor, of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Ladysmith* by Miss S. Staff, of Grimsby, after which the company adjourned to the builders' offices, where cake and wine was served, and the customary toasts given and responded to.

Coot.—Lately there has been launched at Goole, for Messrs. Kelsall Bros. & Beeching, Ltd., of Hull and Manchester, a steel screw steamer of the following dimensions: Length (between perpendiculars), 110 ft.; beam, 21 ft.; depth (moulded), 12 ft. She has been constructed to carry about 140 tons of coal, and has two large trimming tanks in the forehold, capable of holding about 40 tons of water ballast. The vessel has been built to pass Lloyd's highest class, and engines and boiler of good power will be fitted. The vessel was named *Coot*.

Karnak.—Lately there has been launched on the Wear, for the Moss Steamship Co., Ltd., of Liverpool, a screw steamer of the following dimensions: Length, 348 ft.; breadth, 47 ft.; depth, 26 ft. 6 in. The engines and boilers are by the North Eastern Marine Engineering Co., Ltd., Sunderland. The vessel was named *Karnak* by Mrs. Roscoe Hardwick, of Huyton, Liverpool.

LAUNCHES—Scotch.

Namur.—On July 26th there was launched at Greenock, by Messrs. Caird & Co., the screw steamer *Namur*, for the P. and O. Company. Dimensions: Length, 450 ft.; breadth, 52 ft.; depth, 33 ft. 6 in.; gross tonnage, 6,600. The vessel is built to Lloyd's 100 A1 class, and equipped with all the latest appliances for the rapid and efficient handling of cargo. Accommodation is provided for fifty-four first and forty second class passengers. The builders will supply quadruple-expansion engines.

Halcon.—On July 26th there was launched from the yard of the Dee Shipbuilding Company, of Queensferry, a new twin-screw launch built to the order of Messrs. S. Pearson & Son, Limited, of London and Mexico. Her dimensions are 80 ft. by 12 ft. 6 in. by 7 ft. depth. She is provided with a fore-and-aft cabin, and a cargo hold, and is being fitted out for tropical service. All the deck work is of teak, and the saloon panelling of mahogany, and special consideration has been given to the ventilation. Hoskins' patent folding berths are fitted, double awnings are being fitted fore and aft, and the vessel is also fitted out with a salvage pump and arranged for towing purposes. The vessel has been engined by Mr. F. T. Harker, of Stockton-on-Tees, with two sets of triple-expansion engines and a marine-type boiler. The vessel and her machinery have been built under the supervision of Messrs. Flannery & Given, of Liverpool, London, and Rotterdam, and it is expected that the vessel will steam her contract speed of 15 miles per hour when taken out for trial.

Brasil.—On July 26th there was launched at Paisley, for Messrs. Bow, M'Lachlan & Co., Ltd., the steel twin-screw steamer *Brasil*, built by them for the Navigation à Vapor Nicolas Mihanovich Sociedad Anonima, of Buenos Ayres. The vessel is fully equipped with all latest improvements for navigation and for quick handling of cargo. The machinery, supplied by the builders, consists of two sets of triple-expansion engines, supplied with steam from two single-ended boilers constructed for a working pressure of 185 lb. The vessel is classed in Bureau Veritas.

Sergy.—On August 4th there was launched from the Ayr Yard of the Ailsa Shipbuilding Company, Limited, of Troon and Ayr, the steel paddle-steamer *Sergy*, built to the order of Messrs. John M. Campbell & Son, Glasgow, for Mr. Cleto Japi-Assu, of Bahia, and intended for passenger and light cargo service at Bahia. On leaving the ways she was gracefully christened by Miss Bina Clark, Cockerhurst, Shoreham, Kent. The vessel will be shortly towed to Glasgow to receive her machinery, which has been constructed by Messrs. McKie & Baxter, Glasgow.

Parvain.—On August 4th there was launched at Portnockie, by Mr. George Innes, the fishing steamer *Parvain*—the first to be built there—which is to the order of Messrs. Jas. Pirie & Co., Portnockie. The engines will be supplied by a Glasgow firm.

White Heather.—On August 4th there was launched at Bowling, by Messrs. Scott & Sons, an oil-carrying steamer of the following dimensions: 140 ft., by 23 ft., by 10 ft. 6 in.; built to the order of Mr. Henry Burden, Bournemouth. Messrs. Menzies & Co., Ltd., Leith, will supply the machinery. The vessel was named *White Heather* by Miss Ena George, Dunfermline.

Carnarvon.—On August 6th there was launched at Greenock, by Scott's Shipbuilding and Engineering Co., Ltd., a single-screw steamer of handsome model and yacht-like appearance, which they have built for the lighthouse service of the Board of Trade in the Bahamas. The vessel is of the following dimensions: Length, 185 ft.; breadth (moulded), 29 ft.; depth (moulded, to upper deck), 14 ft. 6 in. Above the upper deck is a long topgallant forecastle and an open-sided shade deck, these together covering about three-fourths of the vessel's length. Upon the shade deck is placed the chart-house, with a flying bridge above. The boats, which include a large sailing cargo cutter and a steam launch, are also stowed here. Below the shade deck accommodation is provided for the officers and engineers. The crew are berthed on the main deck forward, while the corresponding space aft is fitted up with rooms for the use of the lighthouse keepers and their families. There are two masts, schooner-rigged, and the vessel has a clipper bow, with a handsomely carved figurehead. The vessel is handsomely furnished, special attention having been given to ensure thorough ventilation. The machinery consists of triple-expansion engines of 800 I.H.P., constructed in accordance with Board of Trade requirements. The cylinders are 15¼ in., 23½ in., 36 in. in diameter, by 30-in. stroke, supplied with steam by two single-ended boilers working at 165 lb. pressure. A donkey boiler and very complete installation of auxiliary machinery have been fitted. The vessel was named *Carnarvon* by Miss Iris Biles.

Evaropa.—On August 7th there was launched at Dumbarton the three-masted schooner *Evaropa*, for Mr. Nicolas Mihanovich, Buenos Ayres. Her dimensions are 215 ft., by 38 ft., by 11 ft. 6 in. She is designed to carry considerable deadweight on a limited draught. Special arrangements are made for the quick handling of cargo by means of powerful steam winches. Miss Ward, Dumbarton, performed the naming ceremony.

Europa.—On August 7th there was launched at Dumbarton, for the Navigation à Vapor Nicolas Mihanovich, a steel vessel of about 850 tons gross, named *Europa*.

Ava.—On August 8th there was launched at Dumbarton, by Messrs. William Denny & Brothers, the steel screw steamer *Ava*, for Messrs. P. Henderson & Co.'s Glasgow and Rangoon service. The *Ava*, like the other vessels of the fleet, has been built to the British Corporation's classification. Her principal dimensions are: Length, 410 ft.; breadth, 52 ft.; depth, 30 ft. 9 in. The accommodation for pasengers is fitted on the top of the bridge deck amidships. In arranging the vessel, special care has been taken with

the ventilation of the passenger accommodation, so that the heat of the Red Sea passage may be mitigated as much as possible. In order to deal with bulky pieces of cargo, the vessel is constructed on the built-pillar and girder principle, which does away with round stanchions, and leaves clear holds. The vessel has no fewer than thirteen derricks, all having an outreach of fully 8 ft. over the ship's side, the lifts ranging up to twenty tons, so that cargo of practically any weight in bulk may be conveniently handled. Messrs. Denny & Co., Dumbarton, will supply the engines. The naming ceremony was performed by Miss Smart, niece of Mr. Innes, managing partner of the owners' company.

Bloemfontein.—On August 9th Messrs. Archibald McMillan & Son, Limited, Dumbarton, launched the steel screw steamer *Bloemfontein*, the first of the two vessels which they are at present building to the order of Messrs. Bucknall Brothers, London. The *Bloemfontein* is of the following dimensions:—Length, 413 ft.; breadth, 50 ft.; depth, 29ft. 10 in.; with long bridge, having accommodation on top for captain, officers, and engineers, besides a number of spare state-rooms, whilst the poop is fitted for a native crew. Electric light is fitted throughout, and the vessel has all up-to-date appliances for the rapid handling of cargo, including derricks, &c., for weights up to thirty tons, and is designed with fine lines. The machinery is being supplied by Messrs. Dunsmuir & Jackson, Limited, Govan. The vessel has been built under the superintendence of Mr. H. A. B. Cole, M.I.N.A., M.I.M.E., M.I.C.E., London. The naming ceremony was gracefully performed by Mrs. Anderson, Peterhead, wife of Captain Anderson, the owners' representative. In proposing success to the new steamer and her owners, Mr. W. M. McMillan referred to the interesting fact that just fifty years ago his firm built for Messrs. Bucknall the three-masted barque *British Ensign*, and also to the fact that there was still in their employment a man who had worked on the *British Ensign*, and who also had been employed in the building of the *Bloemfontein*. Mr. Tom Watt, the workman referred to, is a carpenter, and entered the employment of Messrs. McMillan sixty two years ago, so that probably his is a record for length of service in the shipbuilding trade. Messrs. McMillan have had several other workmen in their employment for close on sixty years, and, needless to say, are proud of such long and faithful services.

Awaji Maru.—On August 10th there was launched at Grangemouth, by the Grangemouth and Greenock Dockyard Company, the steamer *Awaji Maru*, built to the order of the Nippon Yusen Kaisha, of Japan. The dimensions of the vessel are 300 ft., by 38 ft., by 23 ft. 6 in. (moulded). She is built to Lloyd's and Japanese Teishinsho rules, and is intended for regular passenger trade between Japan and China coasting ports. Machinery for a high rate of speed will be supplied by Messrs. Dunsmuir & Jackson, Ltd., Govan.

Queen.—On August 15th there was launched at Port Glasgow, by Messrs. Russell & Co., a steel spar-decked screw steamer, built by them to the order of Messrs. William Thomas, Sons & Co., Ltd., Liverpool. The new vessel has a deadweight carrying capacity of about 7,300 tons, and is of the following dimensions: Length, 385 ft.; breadth, 50 ft.; depth, 27 ft. 6 in. Machinery will be supplied by Messrs. Dunsmuir & Jackson, Glasgow. As she left the ways the steamer was named *Queen* by Miss Ethel Thomas, daughter of the owning firm's senior partner.

Macduff.—On August 15th there was launched at Govan, by Messrs. Mackie & Thomson, the steam trawler *Macduff*, built to the order of the Hellyers' Steam Fishing Co., Ltd., Hull. The dimensions of the vessel are: Length (between perpendiculars), 108 ft. 6 in.; breadth (extreme), 22 ft.; depth (moulded), 12 ft. 4 in.; and gross tonnage, about 180. Mr. W. V. V. Lidgerwood, Coatbridge, will supply triple-expansion engines having cylinders 10 in., 16¾ in., 27 in., by 24-in. stroke, the estimated H.P. being 300, and the speed 9¾ knots.

Pampa.—On August 16th there was launched at Govan, by the London and Glasgow Engineering and Shipbuilding Co., Ltd., a finely modelled steel twin-screw steamer, for the Société Générale de Transports Maritimes à Vapeur, Marseilles, for their passenger and cargo service between the Mediterranean and South American ports. The dimensions of the vessel are: Length, 408 ft.; breadth, 47 ft. 5 in.; depth, 29 ft. 6 in. (moulded, to spar deck); and she measures about 4,600 tons gross. She is built to the highest class of the Bureau Veritas, under special survey, is fitted with double bottom for water ballast, and has all the most modern appliances for manœuvring and for the expeditious handling of cargo. The first-class passengers are berthed in state-rooms amidships on the spar and bridge decks, the second-class passengers under the poop, and the third-class on main deck amidships. The whole of the available space on the main and lower decks will be fitted for emigrants. As the vessel will trade through the tropics, special attention has been paid to ventilation. The vessel was named *Pampa* by Miss Annie Cohan, daughter of Mr. E. A. Cohan, of Messrs. H. E. Moss & Co., Liverpool. The machinery will be supplied by the builders.

Oceana.—On August 17th there was launched from the shipbuilding yard of Messrs. David and William Henderson & Co., Limited, Partick, the large steel screw cargo steamer *Oceana*, which they have constructed to the order of Messrs. Maclay & McIntyre, of Glasgow. This latest addition to the fleet of vessels owned by this firm is, in length, 415 ft. overall, breadth 52 ft., with a depth of 29 ft. 8 in. (moulded), having a gross tonnage of about 4,850, and will be classed in Lloyd's 100 A1, three-deck rule. She has been fitted with all the latest improvements to ensure the rapid and safe working of the large cargo which she has been designed to carry, including nine powerful winches, and also large derricks fitted at the hatches. A complete installation of electric light has been fitted throughout the vessel. Steam-steering gear is fitted amidships. The saloon and officers' accommodation is on the fore end of bridge deck, and a chart room and wheelhouse have been built above this with a bridge, which will give every facility to the officers in the navigation of the vessel. A set of triple-expansion engines will be supplied and fitted by the builders, having cylinders 26 in., 43 in., and 71 in. diameter, by 4-ft. stroke, also two large single-ended boilers, working at a pressure of 180 lb. The vessel was launched without any ceremony.

Boy George.—On August 18th there was launched at Buckle, for Messrs. G. Farquhar & Sons, Janstown, the fishing steamer *Boy George*. The vessel will be towed to Aberdeen, where her triple-expansion engines and machinery will be fitted.

Chucha. On August 18th there was launched on the Clyde, for Buenos Ayres owners, the powerful screw tug *Chucha*, fitted with all the most modern arrangements for dealing with large barges, &c., on the South American rivers, including steam steering gear and windlass. Powerful machinery of the compound surface-condensing type will be fitted.

Retriever.—On August 18th there was launched at Troon, by the Ailsa Shipbuilding Co., Ltd., a steel screw steamer for the Clanrye Steamship Co., Ltd., Newry (Messrs. W. T. Ferris, managers), for their general coasting trade. The dimensions are: Length overall, 174 ft. 6 in.; breadth (moulded), 25 ft. 6 in.; depth (moulded), 12 ft. 8 in.; deadweight carrying capacity, 570 tons. The vessel is to be fitted with compound direct-acting engines, having cylinders 20 in. and 42 in., with a stroke of 30 in., by Messrs. Renfrew Brothers & Co., Irvine. As she left the ways the vessel was named *Retriever* by Mrs. J. H. Russell, Newry.

Alava II.—On August 20th there was launched at Port Glasgow, by Messrs. David J. Dunlop & Co., a steel screw steamer for passenger and cargo service on the Cuban coast. The new vessel, which is named the *Alava II.*, is of the following dimensions: Length (between perpendiculars), 230 ft.; breadth (moulded), 39 ft.; and depth (moulded, to main deck), 12 ft.; with 'tween deck 7 ft. 6 in. high. Accommodation is provided on upper deck in a large steel deckhouse for thirty first-class passengers. The vessel is rigged as a two-masted fore and aft schooner, having strong derricks with cargo winch at each mast for quick handling of cargo. The machinery, which is provided by the builders, consists of one set of triple-expansion engines having cylinders 17 in., by 28½ in., by 47 in. diameter, by 30 in. length of stroke, with two large single-ended boilers.

Registan.—On August 21st there was launched at Dundee, by Messrs. Gourlay Brothers & Co., Ltd., the cargo steamer *Registan*, built to the order of F. C. Strick & Co., Ltd., London. The vessel, which will be engaged in trade between London and the Persian Gulf, is of the following dimensions: Length, 331 ft.; breadth (moulded), 43 ft.; depth (moulded), 24 ft. 9 in.

Melrose.—On August 21st there was launched from the yard of Messrs. Ramage & Ferguson, Ltd., Leith, a steel screw steamer of 2,500 tons deadwight carrying capacity, which has been built to the order of Messrs. Geo. Gibson & Co., Leith, for their trade between Rotterdam and Grangemouth. The vessel, which is of the single-deck type, has been specially designed for rapid handling of cargo, and, as the hatchways are unusually large and eight steam winches and two steam cranes are fitted, this should be ensured. The steamer was named *Melrose* by Miss Radcliffe, niece of Mr. Campbell Gibson. After the launch, the vessel was towed to the Albert Dock, where she will be fitted with her machinery by the builders. This is the fourth vessel built by Ramage & Ferguson, Ltd., for Messrs. Geo. Gibson & Co.

Angus and **Hector.**—On August 22nd there were launched at Govan, by Messrs. Mackie & Thomson, two steam trawlers, built to the order of the Hellyers' Steam Fishing Co., Ltd., Hull. The dimensions of the vessels are: Length (between perpendiculars), 108 ft. 6 in.; breadth (extreme), 22 ft.; depth (moulded), 12 ft. 4 in.; and gross tonnage about 180. Mr. W. V. V. Lidgerwood, Coatbridge, will supply triple-expansion engines having cylinders 10 in., 16½ in., and 27 in., by 24-in. stroke, the estimated H.P. being 300, and the speed 9¾ knots. The vessels were named *Angus* and *Hector*, and the naming ceremonies were performed by Mrs. Mackie and Miss Mackie, Partick.

Comrade, Candidate, and **Caledonia.**—On August 22nd there was launched at Aberdeen, by Messrs. Hall, Russell & Co., three new steam trawlers, built to the order of Mr. Thomas Devlin, jun., Newhaven, of the following dimensions: Length, 112 ft.; breadth, 21 ft.; and depth, 12 ft. 1 in. The trawlers were named respectively the *Comrade*, the *Candidate*, and the *Caledonia*.

Irish Monarch.—On August 22nd there was launched at Old Kilpatrick, by Messrs. Napier & Miller, Ltd., the new vessel, the *Irish Monarch*, which has been built to take the highest class under British Corporation rules, for the Monarch Steamship Co., Ltd. (Messrs. Raeburn & Verel, Glasgow, managers). The principal dimensions of the vessel are: Length (between perpendiculars), 385 ft.; breadth, 48 ft. 6 in.; depth (moulded), 29 ft. 9 in.; with a gross tonnage of about 4,400. Water ballast has been provided for in a cellular double bottom, and also in aft peak, and a large deep tank abaft the engine-room. The vessel has a most complete and convenient arrangement of hatches, derricks, and winches for the rapid handling of cargo. The machinery, which is being supplied by Messrs. David Rowan & Co., Glasgow, consists of triple-expansion engines, with cylinders 27 in., 44 in., and 72 in., by 48-in. stroke. The launching ceremony, which was witnessed by a large crowd, was performed by Mrs. MacKenzie, of Napier, Nairn.

Castalia.—On August 23rd there was launched at Whiteinch, by Messrs. Barclay, Curle & Co., Ltd., a large steel screw steamer for the Indian service of the Anchor line, of the following dimensions: Length, 440 ft.; breadth, 53 ft.; depth, 32 ft. 6 in. (moulded); with a gross tonnage of 6,200 and a deadweight capacity of 8,600 tons. The vessel, which has been built to the highest class of the British Corporation, will be fitted with triple-expansion engines, having cylinders 29½ in., 49 in., and 81 in. diameter, with 4-ft. 6-in. stroke, and will have three large double-ended boilers working at a pressure of 180 lb. There will be ten powerful steam winches, one of them, with warping ends, being placed on the poop for facility in handling the vessel in port. Everything possible has been done to enable the vessel to load and discharge large cargoes with despatch. All holds and 'tween decks are fitted with longitudinal girders, supported by four vertical tubular pillars in each compartment. The 'tween decks are unusually lofty, being 10 ft. in height. The petty officers, cooks, and stewards will be accommodated in the topgallant forecastle, which is 48 ft. long; and the crew in the poop, which is also 48 ft. long. The bridge deck extends to 156 ft., under which the engineers are berthed, and the remaining space is available for cargo or coal. The captain and officers will be berthed abaft of the navigating bridge on the boat deck. Superior accommodation has been provided on the bridge and promenade decks for ninety first-class passengers in two and four berth state-rooms, which are exceptionally large and airy. At the fore end of bridge deck the saloon is placed, which is a spacious apartment. The vessel is fitted throughout with electric light, including a searchlight for navigating the Suez Canal by night. An insulated chamber for storing meat, vegetables, and fruit has been provided, the refrigerating machine being placed in the engine-room. As the vessel left the ways she was named *Castalia* by Miss Winifred Anderson, Glasgow.

Falaba.—On August 22nd Messrs. Alex. Stephen & Sons, Ltd., launched a steel screw steamer of about 4,800 tons, built to the order of Messrs. Elder, Dempster & Co., Liverpool, for service between Liverpool and the West Coast of Africa. Her dimensions are 380 ft., by 47 ft. 6 in., by 34 ft., with engines 29 in., 46 in., and 77 in. diameter, by 51-in. stroke. She has been built to the rules of the British Corporation, and, like her sister ship, the *Albertville*, which ran her trials in the Firth last month, she has been specially arranged for a large number of first and second class passengers—the whole of the upper 'tween decks being fitted up with handsome and roomy state-rooms; while on the shelter deck, promenade deck, and boat-deck, large deckhouses have been built and fitted up with state-rooms, dining-saloons, music and smoke rooms. Special attention has been paid to ventilation throughout the accommodation, and many other features have been added as the result of the experience of the builders and owners of the requirements of vessels for the West African trade. The vessel has been designed to carry a large deadweight on a small draught, and is also intended to maintain a high speed. The previous vessel, the *Albertville*, attained 15½ knots on trial. The holds and cargo gear have been constructed to suit the heavy and bulky cargo handled in this trade, and obstructions in the hold have been reduced to a minimum by the adoption of the girder system of beams. Besides the large cargo holds, there are also spaces fitted up with refrigerating appliances for the carriage of perishable goods, and convenient to the passenger accommodation are baggage-rooms, mail and specie rooms, and the hundred and one conveniences and luxuries demanded by the modern traveller. The vessel was named the *Falaba* by Miss May Thompson, daughter of Captain W. P. Thompson, R.N.R., marine superintendent for Messrs. Elder, Dempster & Co.

LAUNCH—Irish.

Star of Japan.—On August 23rd, Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their North yard a large cargo steamer built for Messrs. J. P. Corry & Co., London. The interesting ceremony of christening the vessel *Star of Japan* was gracefully performed by Miss Corry, daughter of Sir Wm. Corry, Bart. (London, the owner of the vessel, who was present. Amongst those who assembled to witness the launch were Miss Corry and Miss Ethel Corry (Benvue), Miss Workman, Messrs. Robert Corry, James P. Corry, and William Corry (London), J. W. Corry (Belfast), Alex. Macdonald (superintendent engineer of the Star line). The *Star of Japan*, the eighth vessel built by this firm for the Star line fleet, is 456 ft. long, and has a gross tonnage of about 6,300. She has been designed for general colonial trade, and, like the other vessels owned by this line, has been specially arranged for the conveyance of frozen meat and other products from Australia and New Zealand. The vessel has three complete steel decks, extending the full length, the shelter deck being sheathed all fore and aft with pitchpine. The cargo space is divided by steel bulkheads into five spacious holds, the three main holds being insulated and prepared for carrying frozen meat, and refrigerating machinery of the most modern design will be fitted up for the preservation of this cargo during transit. Each of the five holds has a large hatchway, and these will be equipped with ten powerful steam winches, and suitable derricks capable of rapidly loading and discharging heavy cargo. Accommodation is being provided for a number of first-class passengers, who will be comfortably berthed in state-rooms placed in the 'midship deckhouse, having a large dining-saloon, with suitable pantry adjoining. The officers' quarters are also placed amidships, and the captain's rooms are situated on the deck above the saloon-house; the engineers and petty officers will be accommodated in a deckhouse at the after end of the engine casing; and the crew of firemen, seamen, &c., will be housed on the upper deck forward. The engines are of the triple-expansion type, having all the latest improvements, and supplied with steam by four large steel boilers working under Howden's system of forced

draught. The vessel has been built under Lloyd's special survey to qualify for their highest class, and also fulfils the Board of Trade requirements for a first-class cargo steamer.

LAUNCH—German.

Olivant.—On July 25th, the Flensburg Shipbuilding Co. launched from their yard the third of the four cargo steamers in course of construction for the "Roland-Linie," Actien Gesellschaft, of Bremen. Her principal dimensions are: Length overall, 354 ft.; breadth (extreme), 49 ft. 2 in.; depth (moulded) up to spardeck, 28 ft. 6 in.; carrying capacity, about 6,150 tons. The christening ceremony was gracefully performed by Miss Munster, of Hamburg, who named the vessel *Olivant* when leaving the ways.

LAUNCH—Belgium.

Henri Gerlinger.—On August 18th the Antwerp Shipbuilding Company, at Hoboken, launched the well modelled screw steamer *Henri Gerlinger*, built to the order of Messrs. Adolf Deppe, of Antwerp. The vessel, which has been built to the highest class in Lloyd's Register, with special survey, is 230 ft. long by 35 ft. 3 in. breadth by 17 ft. 3 in. depth to main deck, with long raised quarter-deck, extending from engine-room bulkhead aft, bridge deck amidships for cargo, forecastle for accommodation of crew. She is fitted with all the most modern appliances for rapid loading and discharging of cargo, including four powerful steam winches, four derricks, the hatchways being specially large, and eight gangway doors being fitted in bulwarks. The holds are almost absolutely clear, the vessel having been built on the deepframing system for this purpose. The hold pillars are a special feature of this vessel, being built in heavy channel bars riveted back to back, very widely spaced and attached to girder under deck, thus avoiding obstruction of holds. The ship has a cellular double bottom for water ballast, as well as after-peak tank, with dry tank under boiler to avoid corrosion. A powerful steam windlass is fitted on the forecastle deck, as well as a steam warping-capstan aft. Bilge keels are also fitted. The vessel is rigged as a two-mast schooner, with steel lower masts. The deck fittings are all specially robust, and fitted with a view to easy handling of ship, the boats, &c., being to British Board of Trade requirements. The officers and engineers are berthed in houses on bridge deck, and at fore end of same is placed saloon and accommodation for captain in oak and linerusta. The engines will be fitted by the North Eastern Marine Engineering Company, Sunderland, and are of the triple-expansion, surface-condensing type, with cylinders 17 in., 28 in., 46 in., by 33-in. stroke, with one large multitubular boiler 15 ft. by 10 ft. 6 in., working at 160 lb. pressure per square inch. One vertical donkey boiler 14 ft. 6 in. by 6 ft. 6 in., working at 100 lb. pressure, also of the multitubular type. An evaporator is also fitted. The vessel will carry 2,020 tons of cargo on the remarkable small draught of 16 ft. ½ in., and will steam at the rate of 9½ knots per hour with a small coal consumption. The christening ceremony was gracefully performed by Miss Amélie Gerlinger.

TRIAL TRIPS.

Amelia.—On July 28th, the ss *Amelia* (of which we gave particulars in our June 29th issue, page 557), built for the Donald Steamship Co., Ltd., by Swan, Hunter & Wigham Richardson, Ltd., Wallsend, and engined by Messrs. The North Eastern Marine Engineering Co., Ltd., of Wallsend, was taken to sea for her trial trip. The owners were represented by Capt. T. L. Evans and Mr. T. N. Jones, who expressed themselves as highly satisfied with the way everything worked, the speed attained being 12½ knots.

Antar.—On July 28th the new steel screw steamer *Antar* (of which we gave particulars in our June 29th issue, page 558), built by Messrs. The Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne, and engined by Messrs. The North Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, for Messrs. The Egypt and Levant Steamship Co., of London, left the Tyne for her official trial trip. On the trial runs the machinery worked without the slightest hitch, giving great satisfaction to all concerned, and easily maintained an average speed of about 11 knots. Amongst those present were Mr. W. H. Robson (superintendent engineer for the owners), Mr. G. F. Mulherion and Mr. Bourn (representing the shipbuilders), and Mr. Daglish (representing the engine builders). After the trial trip the vessel returned to Tyne Dock to load.

Cresswell.—On July 28th the handsome steel screw steamer *Cresswell* (of which we gave particulars in our June 29th issue, page 558), built by Messrs. Wm. Gray & Co., Ltd., West Hartlepool, and engined from the Central Marine Engine Works of the builders, for Messrs. Jones & Prosser, of London, was taken to sea for her trial trip. The trial was witnessed by Mr. Percy Jones and Mr. Prosser, owners; by Capt. J. E. Murrell and Mr. Wm. C. Borrowman, on behalf of the ship and engine builders respectively; and amongst the visitors on board were Captain Willis, Captains Blacklin (senior and junior), Mr. Walter Jones, Mr. Percy Scott, and Mr. A. G. Murrell, all of West Hartlepool. The engine room staff was in charge of Mr. Wm. Reynard, and, after some preliminary runs, the engines were fully opened out, and a run along the coast, to the mouth of the Tyne and back, was made, during which the performance of ship and engine was all that could be desired, the owners giving expression to their high satisfaction with the work turned out by the shipbuilders and engineers. The average speed of ship during this extended trial was 11·11 knots. The vessel afterwards proceeded to Barry to load.

Don Diego.—On July 28th the new screw steamer *Don Diego* (of which we gave particulars in our June 29th issue, page 557), built and engined by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of the Buenos Ayres and Pacific Railway Co., Ltd. (Messrs. Philipps, Philipps & Co., London, managers), was taken to sea on her official trial trip. After several runs over the measured mile, the vessel attained an average speed of 11½ knots, the trial being in every way successful and satisfactory to all concerned. The vessel afterwards returned to the Tyne to take in bunkers for Newport. Among the company present were Mr. George Dodds, Mr. Harding Green, Mr. James Readhead, Mr. John Readhead; Mr. W. B. Cumming and Mr. Douglas, who have superintended the construction of the vessel; Mr. Lohden, Newcastle; and Capt. Jones, who will take command.

Sommerstad.—On July 31st the steamer *Sommerstad* (of which we gave partiuclars in our June 29th issue, page 556), built on the Tyne for Messrs. A. F. Klaveness & Co., Sandefjord, Norway, went to sea for her official trial over the measured mile, which passed off very successfully, the owners being represented by Mr. Klaveness and Captain Raastad.

Sheaf Field.—On July 31st the screw steamer *Sheaf Field* (of which we gave particulars in our June 29th issue, page 558), built by the Blyth Shipbuilding Company, Ltd., for Messrs. The Sheaf Steam Shipping Company, Ltd. (W. A. Souter, Esq., manager), of Newcastle-on-Tyne, was taken to sea for loaded trial. Triple-expansion engines of ample power have been fitted by Messrs. John Dickinson & Sons, Ltd., of Sunderland; cylinders, 19 in., 30 in., and 48 in., by 36-in. stroke, with one large boiler, working at a pressure of 180 lb. per square inch. Representatives from the owners, builders, and engineers were on board, and on the run over the measured mile a highly satisfactory speed was made, the engines working smoothly throughout. A cold lunch was served on board, after which the success of the *Sheaf Field*, her owners, and other toasts were duly honoured. After trial the *Sheaf Field*, under the command of Capt. Clarke, proceeded on her voyage.

Horden.—On August 1st the steel screw cargo steamer *Horden*, built by Messrs. Wood, Skinner & Co., Ltd., of Bill Quay-on-Tyne, to the order of Messrs. The Burnett Steamship Co., Ltd., left the Tyne for her official trial trip. The vessel, which is a sister ship of ss. *Bi ley*, recently constructed, is of the raised quarter-deck type, with bridge and topgallant forecastle, and has accommodation for the captain under the bridge deck amidships, and for the officers in side houses and the aft end of the raised quarter deck. Water ballast is provided in the cellular double

bottom all fore and aft, and in the fore and aft peak tanks. The vessel has specially large hatches for self-trimming and all the latest deck machinery for facilitating the rapid loading and discharging of cargo. The propelling machinery, which has been constructed by Messrs. The North Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consist of a set of their latest type of triple-expansion engines, having cylinders 19 in., 31 in., and 51 in., with a stroke of 36 in., steam being supplied by a large multitubular boiler working at a pressure of 180 lb. per square inch. A speed of over 11 knots was easily maintained on the trial runs, the machinery working without the slightest hitch, and giving great satisfaction to all present, amongst whom were Mr. J. W. Burnett, managing owner; Mr. Norman Burnett, under whose supervision both hull and machinery have been constructed; Mr. Skinner and Mr. Leslie Skinner, representing the shipbuilders; and Mr. J. Daglish, representing the engine builders. This is the sixteenth vessel constructed by Messrs. Wood, Skinner & Co., Ltd., and engined by Messrs. The North Eastern Marine Engineering Co., Ltd., for Messrs. The Burnett Steamship Co., Ltd., Newcastle-on-Tyne.

Jaguaripe.—On August 2nd the paddle-steamer *Jaguaripe*, built in the Ayr yard of the Ailsa Shipbuilding Co., Ltd., of Troon and Ayr, went on her official trial trip on the Firth. The vessel is intended for service in Bahia Bay, and was built to the order of Mr. Cleto Japi-Assu, for the Government of the State of Bahia, Brazil. Compound diagonal engines have been supplied by Messrs. McKie & Baxter, Govan, and the mean speed attained on the measured mile was fully 10 knots. The *Jaguaripe* is the second of an order for eight vessels placed with the Ailsa Shipbuilding Co., Ltd., for the above service. Messrs. John M. Campbell & Son, Glasgow, are the acting representatives for the vessels in this country. Mr. D. D. Crookston, London, superintended the vessel during construction.

Maltby.—On August 2nd the ss. *Maltby* (of which we gave particulars in our June 29th issue, page 557), built by Messrs. Ropner & Son, of Stockton-on-Tees, and engined by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, made her official trial trip in the Tees Bay. The steamer has been built to the order of Messrs. R. Ropner & Co., West Hartlepool, and is fitted with the builders' patent improved trunk deck. After a very satisfactory trial trip, during which a speed of 11 knots was attained, the steamer proceeded to the Tyne to load for Alexandria. The company on board included Mr. Nicholson, the owners' superintendent; Capt. Fisker, the commander of the vessel; and Mr. J. R. Garthwaite, who was in attendance on behalf of the builders.

Ravelston.—On August 2nd the handsome steel screw steamer *Ravelston* (of which we gave particulars in our June 29th issue, page 558), built by Messrs. Wm. Gray & Co., Ltd., West Hartlepool, and engined at the Central Marine Engine Works of the builders, for Messrs. Gillespie & Nicol, of Glasgow, had her trial trip. The day was fine, and a large company was on board, amongst whom were D. Nicol, Esq., of the firm of Gillespie & Nicol, Glasgow and Grangemouth; T. Cowan, Esq., of Leith; Walter Gillespie, Esq., and James Watson, Esq., of Glasgow; David Walker, Esq., of Grangemouth; Mr. W. Kleyenstuber, of Königsberg; Mr. Ahus, Sweden; Mr. J. Rose, consulting engineer (under whose superintendence the ship and machinery have been built); and James L. Watson, Esq., manager. The builders of the ship and engines were represented by Capt. J. E. Murrell and Mr. Wm. C. Borrowman, respectively. After the usual manœuvring of the ship for the purposes of the compass adjuster, the vessel was headed for the Tyne, and the engines fully opened out, and, against a head wind and a tide, an average speed of 11 knots was recorded by the log, the performance of ship and machinery being entirely satisfactory.

England.—On August 4th the finely modelled steel screw steamer *England*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Fred Drughorn, Ltd., of Rotterdam and London, left the Tyne for her trial trip. The steamer is 370 ft. 6 in. long, by 51 ft. beam, by 26 ft. 6½ in. deep, and has been built, under special survey, to the highest class at Lloyd's, three-deck rule, single-deck type. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation—which is very ample—being placed in steel houses on the bridge deck and under the poop. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes has been arranged for, consisting of seven steam winches, by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne; a large number of cargo derricks, large hatchways, steam-steering gear, by Messrs. J. Hastie & Co.; and steam windlass, by Messrs. Emerson, Walker & Thompson Bros. She is, of course, fitted with the usual water-ballast arrangements for light passages. She has been constructed to a fine model, with a view to rapid speed and economy in fuel, and the machinery has been supplied by Messrs. George Clark, Ltd., Sunderland, consisting of engines with cylinders 24 in., 40 in., and 67 in., by 45-in. stroke, two large steel boilers, 180 lb. pressure. The steamer will carry about 6,450 tons loaded. During construction the vessel has been under the supervision of Messrs. Flannery, Baggallay & Johnson, London. The trial trip proved in every way satisfactory, and a speed of 11½ knots was easily obtained. After the trial trip the vessel proceeded to Cardiff to load for Bombay, under the command of Capt. W. Curtis. Among the guests on board were the following: Mr. J. F. Drughorn, representing the owners; Mr. R. Hodge, representing the builders; and Mr. George Clark, representing the engine builders.

Malinche.—On August 4th the steel screw steamer ss. *Malinche*, which has been built by Messrs. Osbourne, Graham & Co., of Hylton, Sunderland, to the order of The British Maritime Trust, Ltd., was sent to sea for her official trial trip. The steamer has been constructed under Lloyd's special survey, and is of the single-deck type, with poop, bridge, and forecastle. Poop is fitted up for first-class passengers. The steamer is very fully equipped for her trade, and has most modern appliances for the quick handling of cargo. She also has complete installation of electric light and electric fans. The machinery is by Messrs. Richardsons, Westgarth & Co., Ltd. On the trial trip everything was to the entire satisfaction of all concerned, and, after the trial, she proceeded to Fowey to load for South America.

Edernian.—On August 11th the steel screw steamer *Edernian*, built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, and engined by Messrs. The North Eastern Marine Engineering Co., Ltd., Sunderland, to the order of Messrs. Owen & Watkin Williams & Co., Cardiff, was taken to sea for her trial trip, which proved highly satisfactory, a speed of 12 knots being maintained. The owners were represented by Captain Watkin Williams, of the firm of Owen & Watkin Williams & Co., Cardiff, and Mr. T. A. Reed, M.I.M.E., M.I.N.A., superintendent engineer, of Cardiff, both of whom expressed themselves as being highly pleased with the ship and engines. The shipbuilders were represented by Mr. Herbert Taylor, and the engineers by Mr. Geo. D. Weir. After the trial trip the vessel proceeded to Cardiff, under the command of Captain Griffith.

Winona.—On August 11th the ss. *Winona*, built by Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, to the order of Messrs. R. O. & A. B. Mackay, of Hamilton, Ontario, was taken out to sea for her trial trip. The vessel is specially constructed for trading on the Great Lakes, and is of the following dimensions: Length overall, 257 ft. 8 in.; breadth (extreme), 43 ft. 6 in.; depth (moulded), 32 ft. 9 in. The vessel carries a deadweight cargo of about 3,400 tons on 18 ft. 11 in. The machinery has been constructed by MacColl & Pollock, of Sunderland, and consists of a set of triple-expansion engines, having cylinders 20½ in., 33 in., and 54 in., by 36-in. stroke, steam being supplied by two single-ended boilers. The vessel has been built to the rules of the British Corporation for the Survey and Registry of Shipping for their highest class. On the trial trip a speed of 10½ knots was attained. After the trial trip the vessel sailed for Sydney, C.B.

Merel.—On August 14th the steam yacht *Merel* (of which we gave particulars in our July 13th issue, page 604) went on trial, when an average speed of 11¾ knots was obtained.

Arrino.—On August 14th the steel screw steamer *Arrino* (of which we gave particulars in our June 29th issue, page 549), built and engined by Messrs. David & William Henderson & Co., Ltd., Partick, Glasgow, to the order of The Australind Steam Shipping Co. (Messrs. Trinder, Anderson & Co., London, managers), underwent a successful trial trip in the Firth of Clyde, a mean speed of about 14 knots being easily attained.

Brasil.—On August 6th the new twin-screw steamer *Brasil*, built by Messrs. Bow, M'Lachlan & Co., Ltd., Paisley, for La Navegacion à Vapor Nicholas Michanovitch Sociedad Anonima, of Buenos Ayres, went on her trials, which were equally successful, and gave utmost satisfaction to all concerned.

Ibex.—On August 14th this vessel, owned by Messrs. Jackson Bros. & Cory, Ltd., London, sailed from the Tyne, after having undergone a thorough overhaul. She has been fitted with two new steel boilers, 14 ft. 9 in. diameter by 11 ft. 3 in. long, working at a pressure of 160 lb. per square inch, by Messrs. The North Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne. Previous to the *Ibex* sailing, she was taken for a trial trip to the north of the Tyne, when great satisfaction was expressed by Mr. Jackson, of Messrs. Jackson Bros. & Cory, Ltd., and Mr. J. C. Clarke, under whose supervision the whole of the work has been carried out, at the expeditious manner in which the new boilers had been built and fitted, also on the excellent steaming results obtained on the measured-mile trials. The North Eastern Marine Engineering Co., Ltd., were represented by Mr. J. Daglish.

Braunfels.—On August 15th the *Braunfels* (of which we gave particulars in our June 29th issue, page 557), which has been built and engined at the Neptune Works of Swan, Hunter & Wigham Richardson, Ltd., to the order of the Deutsche Dampfschifffahrts Gesellschaft "Hansa," of Bremen, went for a very successful trial trip off the Tyne, the machinery working without the slightest hitch, and giving satisfaction to all concerned. The owners were represented by Mr. D. Wulff, of Bremen, their superintendent engineer, and the builders were represented by Mr. G. F. Tweedy.

Schelde.—On August 15th this tug was taken for her trial trip on the measured mile at sea, and attained a speed of about 11 knots per hour. The vessel is 144 ft. long by 25 ft. broad and 14 ft. 6 in. depth of hold, and hull and machinery have been constructed by Messrs. Wilton's Engine Works and Slipway, to the order of the International Tug Co., who have been assisted during the execution of the work by Messrs. Flannery & Gregson, of Rotterdam, London, and Liverpool. The tug is fitted with powerful steam windlass and steam-steering engine, and is amongst the largest and most powerful tugs afloat. She has bunker capacity for twenty days, and, after a very successful trial trip, has commenced service by a run to Egypt with three craft in tow.

Kossuth.—On August 16th the large steel screw steamer *Kossuth* (of which we gave particulars in our July 13th issue, page 603), built by Messrs. R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough, and engined by The North Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, for the Hungarian Levant Steamship Co., Ltd., of Budapest, proceeded to sea to complete her official trials in a loaded condition. The results were pronounced entirely satisfactory to all concerned, the vessel registering an average of over 10½ knots during a continuous run extending over six hours.

Haimon.—On August 18th the steamer *Haimon*, built by the Flensburg Shipbuilding Company, left the Flensburg harbour for the official trial trip. This passed off most satisfactorily. This steamer is the second of four large steamers in course of construction for the same firm. Her chief dimensions are as follows: Length overall, 354 ft.; length between perpendiculars, 340 ft.; breadth (extreme), 48 ft. 6 in.; depth (moulded) up to spar deck, 27 ft. 6 in.; carrying capacity, 5,400 tons deadweight. The steamer, which is classed to Germanischer Lloyd's ✱ 100 A4L, Spar deck, is fitted with triple-expansion engines of 1,450 H.P. After conclusion of the trial, the *Haimon* proceeded, under the command of Capt. A. Willemsen, through the Kaiser Wilhelms-Kanal to Bremerhaven.

Dipton.—On August 21st this vessel was taken out on her official trial trip, which was successfully carried out, a speed of 11½ knots being easily maintained. She has been built by Messrs. Furness, Withy & Co., Ltd., Hartlepool, and engined by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, to the order of Messrs. The Peareth Steamship Co., Ltd. (Messrs. Beckingham & Co., managing owners). The vessel proceeded to Cardiff. Mr. J. H. Beckingham and Mr. L. Beckingham represented the owners.

Strathspey.—Lately the steamer *Strathspey*, built at Greenock, went out on her trial, when she attained a speed of 12·4 knots on the double run between the Cloch and Cumbrae lights.

Formosa.—Lately the steamer *Formosa* (of which we gave particulars in our June 8th issue, page 486), built by the London and Glasgow Engineering and Shipbuilding Co., Ltd., Govan, for the Société Générale de Transports Maritimes à Vapeur, of Marseilles, ran her steam trials on the Firth of Clyde, when everything was most satisfactorily completed, to the entire satisfaction of the owners and their superintendents.

Osmanieh.—Lately the new twin-screw steamer *Osmanieh* (of which we gave particulars in our May 18th issue, page 413), owned by the Khedival Mail Steamship Company, Ltd., has just successfully undergone her trials in the North Sea.

OBITUARY.

Robert Adam, Ex-Chief Engineer.

IT is with very great regret we have to record the death of Robert Adam, late chief engineer of the British India Company's ss. *Goorkha*, at Helensburgh, Dumbartonshire, somewhat suddenly on Thursday night, July 26th.

In our May 18th issue a report appeared in our columns of a presentation made to Mr. Adam on the occasion of his retirement, so that he has not lived long to enjoy his pension from the company he served so faithfully, after over thirty years' service.

When Messrs. Denny & Co. were building the *India* and *Goorkha*, in 1881, at Dumbarton, Mr. John Tait, who died some years ago, was appointed to the former as chief engineer, and Mr. Adam to the latter steamer, which he only left in May, 1906, when he retired from active sea service. He was well known and highly popular, both with passengers travelling to and from India, and with his brother engineers, besides being highly respected by a large circle of friends. During his time in port he occupied rooms in Romford-road, opposite the premises of the Institute of Marine Engineers, on the roll book of which he was entered as No. 13, thus being one of the pioneer members.

The funeral took place on Monday, July 30th, a service being held at the house at Helensburgh, attended by the relatives, and Messrs. Alex McLean (chief engineer), Gillespie (chief engineer), D. Black (superintendent engineer, Calcutta), Roake (India Railway Service), and James Adamson (hon. secretary Institute Marine Engineers). On the way to the pier at Craigendoran, the hearse was followed by those who attended the service at the house, joined by a number of local gentlemen, and by Messrs. John Clark (superintendent engineer), Primrose, Robertson, Rennie, and Ness (chief engineers). After crossing by steamer to Greenock, the funeral assemblage was further joined by others, amongst whom were Messrs. W. Currie (Director British India Company), D. Currie, J. G. Dobbie (superintendent engineer), D. Niccol, J. B. Stevenson, Doctor, Todd, Thomson (chief engineers, B.I.S.N. Co), R. Elliott (Lloyd's surveyor), and others.

The body was laid to rest in the beautiful cemetery at Greenock, where the family ground is situated. A large number of wreaths covered the coffin, in token of regret that one who was so highly esteemed had been called away from those who had looked to enjoy his companionship for many days to come.

George Browne, Shipowner.

BY the death recently of Mr. George Browne, of Messrs. Browne & Watson, shipowners and shipbrokers, Glasgow has lost a citizen who, besides occupying for many years a prominent position in business, was long and intimately associated with public bodies concerned with City affairs, and with the development of Glasgow as a shipping port and a seat of engineering industry. Deceased, who had reached the eighty-third year of his age, was born in the Peeblesshire village of Kircurd, and was apprenticed to the legal profession in Glasgow at the age of fourteen. He qualified as a lawyer, and eventually received the appointment of Procurator Fiscal at Greenock. Becoming dissatisfied with his prospects in the profession, and returning to Glasgow, he entered upon the business of shipbroking, joining in partnership with Mr. James Watson, who, however, left the firm five years later and became connected with the iron trade. Mr. Browne continued to carry on the business under the original name of the firm, members of his family being ultimately associated with him. Of the public bodies with

which Mr. Browne was connected, the most important was the Clyde Trust. To the affairs of this great undertaking he devoted himself for many years with untiring energy. Besides taking an active part in the general work of the Trust, he was convener of the Harbour Committee, and in this capacity was specially interested in maintaining the efficiency of the equipment of the port. The deepening of the river was a subject that engaged his close attention, and in the prolonged legal controversy between the Trust and Lord Blantyre, Mr. Browne was one of the most strenuous upholders of the Trustees' contention in the dispute. Locally, however, his name became most prominent in connection with the Parliamentary fight between the Corporation of Glasgow and the ancient burgh of Crosshill, on the question of annexation, Mr. Browne, as the chief magistrate of the Southern Burgh for very many years, taking the leading part in resisting the movement. Eventually, however, the feeling in favour of annexation became more general, and, yielding to the change of public opinion, Mr. Browne—the "perpetual Provost," as he had come to be called -relinquished his opposition, and annexation was ultimately accomplished. Another of the prominent undertakings with which he was connected was the promotion of the Cathcart District Railway. This undertaking, which did much to develop the southern suburb as a residential district, afterwards came under the management of the Caledonian Railway Company. For many years Mr. Browne was chairman of the company, and occupied the position at the time of his death. Mr. Browne is survived by three sons and two daughters, one of the sons, Bailie Richard Browne, being a member of the Glasgow Corporation.

Alexander Shanks, Shipbuilder.

THE death took place recently, at his residence in Dalmuir, near Clydebank, of Mr. Alexander Shanks, formerly a partner of Messrs. Napier, Shanks, & Bell, shipbuilders, Yoker, who were the predecessors of Messrs. Napier & Miller, Limited, until recently of Yoker, but now of Old Kirkpatrick. For many years deceased served with the renowned firm of Robert Napier & Sons, and Lancefield and Govan, in the capacity of chief draughtsman, and in supervising the handing over of contracts for the firm at home and abroad. He represented the laying-out of the Turkish Imperial Dockyard at Constantinople, and was made a Bey by the Sultan on the conclusion of his engagement. Returning to this country he was appointed manager of the engineering department at Lancefield. About the year 1877 he joined with Messrs. R. T. Napier, Mr. Henry M. Napier, and Mr. T. Bell, in the shipbuilding works at Yoker, and continued to be associated with them as partner until about 1898, when the change which then took place in the constitution of the firm, and his own indifferent health, brought about his retirement.

James Dredge.

IT is with the deepest regret that we have to announce the death, on August 15th, of Mr. James Dredge, who for over forty years has taken a prominent place in the conduct of our contemporary "Engineering," and with its offshoots, notably, "Traction and Transmission," in which he took the keenest interest until its discontinuance in 1904. Mr. James Dredge, who at the time of his death was in his sixty-seventh year, was born at Bath, on July 29th, 1840. He commenced his professional training at an early age, under his elder brother, the late Mr. William Dredge, who was established in London as a civil engineer. In 1858 he took service under the late Mr. D. K. Clark, and was with him for four years. In the year 1862 he was working under Mr.—afterwards Sir—John Fowler, where he remained for some time .

Mr. Dredge's connection with "Engineering" dates practically from its commencement, in January, 1866, he having become associated with the late Mr. Zerah Colburn, who for some time was the editor of the "Engineer," finally severing his connection with that journal in 1864, and in the following year bringing out the first number of "Engineering." Mr. Dredge at that time took charge of matters connected with illustrations, but, on the death of Mr. Colburn, in 1870, he joined Mr. Maw as co-editor.

Mr. Dredge was a member of the Institution of Mechanical Engineers and Civil Engineers, also a member of, and for some years served on the council of, the Society of Arts, and was an honorary member of the American Society of Mechanical Engineers.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C denotes First Class; 2C Second Class.

July 28th, 1906.

Aimers, W. N.	1C	London
Andrew, S. A.	2C	N. Shields
Barnby, R. A.	2C	N. Shields
Coapes, Harry	1C	Sunderl'd
Cotter, J. N.	2C	London
Fallon, A.	2C	Greenock
Foster, G. A. J.	2C	Hull
Fraser, James C.	2C	Aberdeen
Godtschailk, F O.	2C	N. Shields
Grant, Andrew.	1C	Aberdeen
Gray, John H.	2C	Greenock
Greig, K. L.	1C	N. Shields
Gurney, H. L.	1C	London
Hall, Fred	2C	Liverpool
Harvey, Charles	1C	N. Shields
Higgins, John J.	1C	N. Shields
Hodgson, R.	2C	Sunderl'd
Howard, G. H.	1C	Liverpool
Matthews, H. E. J.	1C	Bristol
M'Bean, Robert.	1C	London
M'Kenzie, John.	1C	N. Shields
Montgomery, A.	2C	Lon'derry
Morrice, William	2C	London
Mothersdale, J. W.	2C	N. Shields
Murray, John	1C	Bristol
Nelson, C. W.	1C	Sunderl'd
Newton, J. E.	1C	N. Shields
Newton, Norman	1C	Bristol
Pittas, D. N.	1C	N. Shields
Price, Francis W.	1C	London
Prior, John R.	1C	Sunderl'd
Ross, Alfred A.	2C	Aberdeen
Smith, Frank G.	1C	Sunderl'd
Smith, John J.	2C	Aberdeen
Steel, Robert H.	1C	Liverpool
Summer, James.	1C	Liverpool
Taylor, W. W.	2C	London
Towers, Robert.	1C	Aberdeen
Wagg, W. H.	1C	Hull
White, C. E.	2C	Hull

August 4th.

Armstrong, F. J.	1C	N. Shields
Calder, Norris E.	2C	Leith
Campbell, W. M.	1C	London
Crofts, Morley P.	2C	Cardiff
Dickinson, R. T.	1C	London
Evans, Watkin	1C	Liverpool
Flyger, Arthur A.	2C	Cardiff
Fogg, Arthur	2C	Cardiff
Graham, William	2C	Glasgow
Hewgill, G. A.	1C	Glasgow
Horne, David G.	2C	Leith
Jones, Evans J.	2C	Cardiff
Lawson, J. M.	1C	South'ton
Lewis John T.	1C	Liverpool
Leybourne, W. E.	2C	N. Shields
Lockhart, T. G.	2C	Belfast
Love, A. McA.	1C	Glasgow
Lund, John	1C	Liverpool
Mansfield, G. J.	2C	Cardiff
Martin, Thomas.	2C	Glasgow
Mock, K. A. D.	1C	Cardiff
Morgan, John	1C	Cardiff
Oag, James	2C	London
Parish, Edgar	2C	Liverpool
Partington, C. F.	1C	Liverpool
Pepper, W. E.	1C	London
Pike, Edward J.	2C	South'ton
Purvis, Septimus	1C	N. Shields
Reynolds, G. H.	1C	Liverpool
Ross, William	1C	Glasgow
Scott, James	2C	Glasgow
Seaward, T. A.	2C	Cardiff
Stevenson, D.	2C	Glasgow
Thompson, J. L.	2C	Glasgow
Tsoukas, D.	1C	Leith
Urquhart, J. A.	2C	Glasgow
Valentine, E. N.	2C	Cardiff
Walker, Frank A.	1C	Liverpool
Watt, William	2C	Glasgow
Wilson, James	2C	London
Wishart, W.	1C	Glasgow
Wright, Henry.	1C	Leith
Yule, Robert	1C	Liverpool

August 11th.

Allen, John C.	2C	N. Shields
Blackmore, W. J.	1C	London
Brand, A.	2C	Liverpool
Cassie, J. M.	2C	London
Crabtree, R. B.	2C	Liverpool
Criddle, W. A.	1C	Liverpool
Dawson, C.	2C	N. Shields
Garnett, John	2C	Liverpool
Hamilton, J. H.	2C	N. Shields
Jack, Thomas J.	2C	Liverpool
Jenner, H. L.	2C	London
Johnson, R. D.	1C	London
Matthews, G.	2C	N. Shields
M'Intyre, N. J.	2C	London
Moss, Thomas H.	2C	N. Shields
Patterson, A.	2C	N. Shields
Potter, Ralph J.	1C	N. Shields
Robertson, A. J.	2C	N. Shields
Sambrook, G.	1C	London
Skinner, W. J. A.	1C	London
Spence, William	1C	London
Still, Albert P.	1C	London
Sutcliffe, R.	1C	N. Shields
Swatridge, W. O.	1C	N. Shields
Swenson, E. H.	2C	N. Shields
Thomas, R. C.	1C	Liverpool
Weir, Andrew	1C	London
Withers, E. R.	1C	London

August 18th.

Adams, J. C. S.	1C	London
Andrews, J. J.	1C	Dundee
Arnold, R. N.	2C	London
Barr, David L.	2C	Greenock
Binks, H. T.	1C	Hull
Bonnar, J. M.	2C	Dundee
Bowman, John	1C	N. Shields
Burn, W. H.	2C	N. Shields
Burns, W. M.	2C	N. Shields
Butt, Herbert A.	1C	Hull
Byrne, Miles	2C	Liverpool
Caffrey, C. J.	2C	Dublin
Chapman, G.	1C	London
Crawford, J. W.	2C	Greenock
De Jong, John	2C	London
Dodd, James	2C	Liverpool
Don, James S.	1C	London
Elston, G. M.	2C	Hull
Fuller, J. H.	2C	London
Galloway, J. F.	1C	London
Gasking, S. S. C.	2C	Liverpool
Hall, Harry R.	2C	Hull
Halliday, L. G.	2C	Liverpool
Hart, E. J.	2C	Liverpool
Hodgson, G. W.	2C	Hull
Jackson, W. S.	2C	Greenock
Jones, John H.	2C	Liverpool
Lambert, J. W.	2C	N. Shields
Lyon, John	2C	Greenock
Mallitte, L. A.	1C	Greenock
M'Cullen, J. A.	2C	Dublin
Metcalf, Thomas	2C	Hull
Montgomery, S. J.	2C	Greenock
Nichols, G. H.	1C	N. Shields
Park, Edward S.	2C	Liverpool
Rudd, Albert	2C	N. Shields
Sibun, Richard G.	2C	London
Simkins, E. J.	1C	Liverpool
Simpkins, J. W. P.	1C	London
Smith, David	1C	Greenock
Smyth, Samuel.	2C	Liverpool
Stark, Richard	1C	Hull
Thomson, Tom.	2C	Greenock
Wharton, C. R.	2C	Hull

The Marine Engineer

And Naval Architect.

LONDON, OCTOBER 1, 1906.

THE agitation for an increase in the shipbuilding programme, organised by what the "Speaker" wittily styles "the blue funk school," has been productive of some interesting speculations as to the nature of the battleship of the future. There are two schools of thought, the professors of which have delivered themselves on this subject. On the one hand, there are those who believe that we shall see the *Dreadnought* outdone; indeed, they hold that already the Germans are laying down vessels which outclass the *Dreadnought*, and which will bear to her much the same relative position that she does to her immediate predecessors. Opposed to this school are those who proclaim that the present policy of big ships is altogether mistaken, and that the nations will discover this before long, will find that they are wasting money in the endeavour to give these huge ships a knot or two extra speed, and will presently return to more moderate dimensions. Whatever may be said by those who thus belittle the tactical value of speed, there can be no question that we have, by the construction of the *Dreadnought*, converted the other naval Powers, and instilled them with a belief in the big ship. That they are preparing to imitate the *Dreadnought*, and to improve upon her, if possible, is certain; the point of importance is what shape their proposed improvements will take, and how far they will achieve their object. According to a French writer, the battleship will by 1915 have increased in displacement to 25,000 or 26,000 tons, and in cost to nearly £3,000,000 apiece. There is no practical difficulty in the way, and it may be that the first nation to add a 25,000-tonner to her active fleet will be as far ahead of her rivals as we are of ours to-day, and for the same reason. It is rumoured, indeed, that our new "Dreadnought" will have a tonnage of 20,000, and will thus again outclass the ships which Germany is reported to be laying down; but we have witnessed too many changes in design and in size and in other matters affecting the type of battleships, to be inclined to predict what the future may bring forth in this direction.

With regard to the German "Dreadnoughts," it has been stated that the armament of these ships in the principal battery will consist of sixteen 11-in. guns, and that their displacement is to be 19,000 tons. It has been claimed that this increase in size and weight of armament will render these vessels more formidable than the British *Dreadnought;* but at present no evidence has been adduced in support of this allegation. It is more than probable, indeed, that ships thus armed would be overcrowded with guns—a fault which has been prevalent in German warships. While, however, so little is known about the design of these new ships, it is a waste of time to speculate upon the possibility of their superiority to a vessel which is herself at present untried. The French "Dreadnoughts," too, so far as their design is concerned, are still somewhat in the air, and, in any case, the three which are first to be laid down show no important advance on our *Dreadnought*. In America, while the system adopted for the distribution of the armament permits of all the guns being fired upon either broadside, neither in number nor in kind will the armament be superior to that of the *Dreadnought*. It is true that Signor Cuniberti, the Italian Naval Architect, has evolved a design which—on paper, at least—has some points ahead of the *Dreadnought;* but there are no signs at present of anybody making this design their own. We may see an immediate advance upon present dimensions; but, remembering that such a move must carry with it another large increase in expenditure on "docks and dykes and dredging," it seems more probable that for a while, at any rate, all the Powers will stick to the "Dreadnought" lines.

THE paper upon the manufacture of tinplates by Mr. R. Beaumont Thomas, which was read before the Institution of Mechanical Engineers, is of interest as showing that this manufacture, though having been depressed since the year 1891, which was a record year for industrial output, is still a very large annual product, even in face of the imposition of hostile tariffs. It had been thought that this trade, as a South Wales product, has by no means been put a stop to by the heavy United States tariffs against us. There is no doubt that these United States tariffs have caused the formation of a large and local business in the States, which has largely caused the making of as large a trade in tinplates in the United States as is equal to the whole of the South Wales trade; but still, this trade remains much beyond the production of 1878 to 1881, leaving a large proportion, viz, over a million and a half, spent in direct wages, and a large proportion of seven millions, distributed over the South Wales industries, to produce nearly eight millions of the final value of the tinplates. This speaks of the year 1905, which is the latest in which records are out, and are, therefore, most effective, as representing the present trade. In 1849, the export of tinplates was a leading feature, and it may be noted that the trade has more than doubled itself every ten years up to and including the year 1891; after this date, the trade has been kept back, having lost its natural rate of increase, by reason of the American and other hostile tariffs, the trade being now at the same level as in 1891. Notwithstanding all difficulties, South Wales continues to hold the premier position as the cheapest district for producing tinplates of a satisfactory quality; and even now, after the original rebuff in 1892, the trade is still working upwards and onwards, the price of production being much less than

in the year 1891. The chief use to which tinplates are put to-day is that of casing petroleum, and it is estimated that in 1905 nearly 2,500,000 cwt. were used for this purpose. Other uses to which they are put are the manufacture of dairy utensils and the canning of food, such as beef in America, salmon in Canada and the United States, mutton and fruit in Australia, fruit in California, oysters and lobsters on the American Continent; sardines, peas, and other vegetables in France, Spain, Italy, and Portugal; pineapples in Mauritius and Singapore, milk in Switzerland, and many other articles. The general rate for labour in the tinplate trade appears to be good at present, so that, though there is a tendency to produce at a cheaper rate, wages do not seem to be affected. We will wish the South Wales trade well in fighting hostile tariffs.

We must not omit a notice of Mr. T. Hurry Riches and Mr. Thomas E. Heywood's paper amongst those submitted to the Institution of Mechanical Engineers upon the mechanical appliances used in the shipping of coal at Portsmouth Dock, as it gives us and our readers a very interesting memoir of the whole appliances used at this dock. It is stated that at this dock there are no less than twenty-one coal-tips, of which fifteen are on the dock and six on the basin. Eight of the tips on the dock and two on the basin are as originally constructed when the dock was made. Of the remainder, three were erected by Messrs. Armstrong & Co. in 1893, and four were put down by Messrs. Tannett, Walker & Co. in 1905-6. Four of the basin-tips were constructed by Messrs. Fielding & Platt in 1899-1900. The business of this dock has largely increased since its first construction, and the later tips are better and more improved than were the first tips. These latter were worked from a high, level road, and the waggons can be tipped from any height between 3 ft. and 17 ft. above the quay level, or 29 ft. above water-level, when there is 32 ft. of water on the dock-cill. In the case of the Armstrong tips, they are capable of tipping waggons at any height between 3 ft. and 37 ft. above the quay level, or 47 ft. above the water-level, when there is 32 ft. of depth on the dock-cill. This is a decided improvement upon the old original tips as constructed at the time of the docks. The hoist rams are two in number, one $13\frac{3}{4}$ in. and the other $5\frac{1}{2}$ in. in diameter. The tipping-ram is $11\frac{3}{4}$ in. diameter. The two main hoist-rams can be used independently of one another, and it is only necessary to use both rams when the heaviest waggons are tipped. These tips can deal with waggons of 22 tons at a high speed. The four movable tips on the basin erected by Messrs. Fielding & Platt are direct-acting hoists, to deal with waggons of a gross weight of 25 tons, whilst the cradle can travel at a speed of 180 ft. per minute. Waggons may be tipped at any height between 4 ft. and 45 ft. above the quay-level, or 55 ft. above water-level, when there is 32 ft. of water on the cill. Messrs. Tannett, Walker & Co. started the erection of four tips, of which two are fixed and the others movable. There are three hoist-rams, two $8\frac{3}{4}$ in. diameter, and the central ram $6\frac{1}{2}$ in. in diameter. The waggons can be tipped at any height between 3 ft. and 45 ft. above the quay level or with a height of 57 ft. above the water-level, with 32 ft. upon the cill. Four valves, the design of Messrs. Riches & Golding, are provided for each set of rams, two pressure-valves and two exhaust-valves. These are equilibrium-valves, and of very simple construction, and, when used as stop-valves, the rapidity of closing or opening is very advantageous, as they can be operated by a lever little more in length than the diameter of the valve. Fine engines by Messrs. Tannett, Walker & Co. are described as supplied with this plant for pumping. The design of the hydraulic-pressure pipes are also shown and described.

LAUNCH OF A PERUVIAN CRUISER AT BARROW.

On September 24th, the second cruiser built at Barrow-in-Furness by Vickers, Sons & Maxim was launched by Senora Rosa Valle Riestra de Lemike. She was named *Coronel Bolognesi*, after one of the distinguished Peruvian Generals. Her sister ship, launched some months ago, the *Almirante Grau*, is practically completed, and is now on her trials. She took her dock trials a few weeks ago, and gave every satisfaction. The *Coronel Bolognesi*, which is somewhat different to the *Almirante Grau*, is 370 ft. long, with a breadth of 40 ft. 6 in., and a draught of 14 ft. 3 in., which will enable her to enter most of the harbours of South America. Her displacement is 3,200 tons. She will be driven by two sets of four-cylinder, triple-expansion engines, each set having four cranks, balanced on the Yarrow-Schlick-Tweedy system, which will give a collective I.H.P. of 14,000, with 250 lb. of steam on the engines and 280 lb. at the boilers. A speed of 24 knots is expected, and she will have a coal endurance at cruising speed of 4,500 sea miles. The vessel is effectively protected. She has a protective deck of $1\frac{1}{2}$ in. in thickness, extending the whole length of the vessel, covering her magazines, boilers, and machinery. Large bunker accommodation is arranged on each side of the vessel, and this adds to the protection of the machinery. Nickel steel, 3 in. thick, has been utilised in the construction of the conning-tower forward. She carries a 6-in. gun, in an armoured shield, on the forecastle deck forward, and another on the quarter-deck aft, and facilities have been provided for the rapid handling of ammunition and projectiles. There are electric motor ammunition hoists of the dredger type, protected by armoured tubes. The secondary armament consists of eight 14-pounder quick-firing guns, and eight $1\frac{1}{4}$ lb. guns, distributed principally on the broadside and on the upper deck and bridge. Two submerged tubes are provided for the firing of 18-in. torpedoes. Two of her weapons fire a 100 lb. shell, at a velocity which will be effective at an unarmoured vessel at three miles' range, and it is expected, with her high speed, she will be able to harass armoured slower ships. The comfort and convenience of her officers and crew have been considered for the variable climate of the region of Peru. There is a complete installation of ventilation and radiators are provided for cold weather. The ship is provided with an ice-making plant and with refrigerating machinery. The Admiral has a walk provided for him as in larger vessels. The two ships built at Barrow for the Peruvian Government may be regarded as the beginning of a new navy for Peru. She has not possessed one since her late war with Brazil; but there is reason to expect that these two powerful cruiser scouts will do good service for the Republic until the national finances are available for providing vessels more calculated to face a powerful foe.

THE SCREW PROPELLER.

III.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., &c.

IN July, 1836, a patent was taken out by the now celebrated John Ericsson, who was then an engineer in London, in partnership with one Braithwaite; and it may be mentioned, in passing, that this firm in 1827 constructed the machinery for the *Victory*, the first steamer to visit and be employed in the Arctic regions, and which, besides having an arrangement whereby the wheels were lifted out of the water when the ship was required to sail, or when in the ice pack, had boilers which worked by a system of forced draught. Ericsson proposed to propel a ship by two screws, very similar in design to that already referred to as the invention of Church, but having a larger number of blades than Church proposed without extending them to the boss, as may be seen by Fig. 7. These screws were right and left handed, and intended to be moved in opposite direction; the foremost propeller was fitted to a hollow shaft, through which the shaft of the aftermost ran. Both screws were run by the same engine by means of an auxiliary shaft geared to the main outer shaft by wheels, and driven from the main inner, or crank, shaft by an auxiliary pair of cranks on the fore end of it, connected to the main cranks by rods, as shown in the figure. Ericsson proposed to run the aftermost screw at a higher velocity than the other, and he appears to have carried this idea out in the screw steamer *Robert F. Stockton*, of which Fig. 7 is a section.

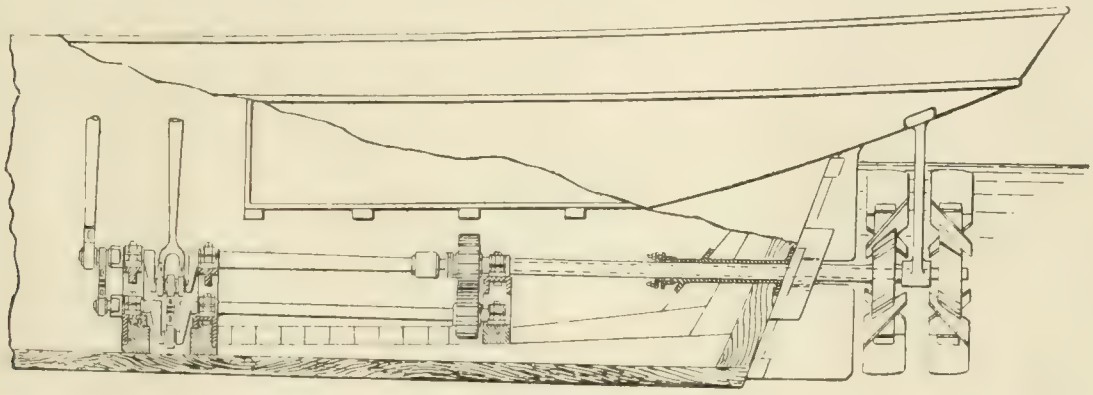


Fig. 7.

In 1838 James Lowe obtained a patent for making propellers with one, two, or four blades of curved form, and which, from the drawings, appear to be narrow and of the shape of a gardener's pruning-knife. In 1838 Peter Taylor, a rope merchant, of Lancashire, took out a patent for improvements in machinery for propelling ships, and proposed to fit what is now known as twin screws, but with the blades interlocking, so, evidently, he had not anticipated the independent use of the screws for navigation whereby the ships are turned by means of one screw going ahead and one astern. The well-known David Napier, then an engineer at Millwall, proposed and patented two screws, each with twelve blades placed on each side of the stern, about a quarter of their diameter above the water-line, and working one in advance of the other and turning in opposite directions. To test this invention, Napier had a ship built, but the speed obtained on trial was much less than had been expected, so nothing, however, came of this adventure. Onlookers at the time were of opinion that the failure in speed was due rather to the improper form of the ship than to any defects in the propellers, and there is no doubt that for such a system very much finer lines, especially on the waterlevel, would be necessary to supply the wheels with the necessary amount of water. In 1844 Bennet Woodcroft (increasing-pitch Woodcroft), who was then described as a printer at Manchester, obtained a patent for an invention whereby he could "vary at pleasure the angle of screw propeller blades on the axis upon which they worked, according to the varying circumstances of wind, current, tonnage, and other conditions affecting the action of the motive power in vessels." In point of fact, this was the beginning of the numerous forms of feathering propeller blades that were popular until the use of sails was in most ships abandoned. Such screws, however, still remain in some yachts on which long voyages are made, such as the Pacific Ocean, and where coal is not easily obtained. The particular design which survived until to-day is due to the inventive genius of the late R. R. Bevis, of Birkenhead, whose patent, while based upon the general principles of those that had preceded his, has some distinct and valuable features of its own, and hence its survival.

In the years 1845 to 1847, several patents were taken out for methods of raising the propeller out of the water to avoid its resistance when the ship was under sail. In most of these designs it is proposed to fit the propeller abaft the rudder, and, in the case of Henwood's patent of 1847, the rudder is placed on the fore side of the propeller, and below the shaft only; eventually, however, the lifting screw was placed on the fore side of the rudder post, and hung in what was called a "banjo frame," so arranged that the screw could be lifted up through a well above it, on to the deck of the ship, where it could be examined, altered, or repaired at pleasure. During this period various patents were taken out also by inventors for screws distinguished by having a more or less peculiar shape of blade, and which may be said to be their only merit, as none of them have survived, nor have any of their peculiar characteristics been merged into any modern design of propeller.

In 1849, however, a new and original designer appeared, named Robert Griffiths; he was a civil engineer, and resident in Havre, France. This gentleman, before rushing into the Patent Office, had made careful experiments for determining the value of water currents at the various parts of the screw propeller when the vessel was in motion. He appears to have been the first engineer to perceive that small refinements in the way of varying the pitch were of no real consequence what-

* For articles 1 and 2, see August and September issues.

ever, for he had grasped the fact that a propeller blade moving through the water with great rapidity must of necessity drag with it a mantle of water, and this mantle probably assumed the form of a true-pitched helix with a pitch of its own. He therefore rightly argued that a propeller blade made with a true pitch could not be inferior to the blade with variable pitch, whether it was Bennet Woodcroft's design, where the pitch was increased from the leading edge to the following edge; or Atherton's, where the pitch increased from the boss outward to the tip.

He also ascertained that practically no good came from the middle part of the propeller, as, instead of contributing to the effective thrust, it only set up eddies which probably interfered with the efficiency of the outer part of the blades. He therefore added a large spherical boss, whose diameter was from one-quarter to one-third that of the propeller; he found a marked improvement in the efficiency of all the propellers to which he had fitted these large bosses. It is, moreover, due to Mr. Griffiths that we have to-day the pear or leaf shaped propeller blade almost exclusively, for it was he who first proposed the blades to be narrow at the tip and broad at the root, and proved its superior efficiency to the common screw, although it is only, perhaps, right to say that previous to the taking out of this patent, some engineers had already cut away a triangular piece from the corner of the leading side of the "common propeller," as it is still sometimes called, so that the part remaining bore a likeness to the "Hirsch" blade, as also to the blades of some other even more modern designers. The benefit obtained by thus reducing the breadth of the outer part of the common screw led to the cutting away of the "following" corner, but the increment of improvement was not so large in this case as had been obtained before, probably due to the fact that the surfaces of these propellers were thereby reduced to being too small an area for the power transmitted to them.

Mr. Robert Griffiths continued to contribute to our knowledge of the screw propeller for more than thirty years after his first patent was obtained, and, although

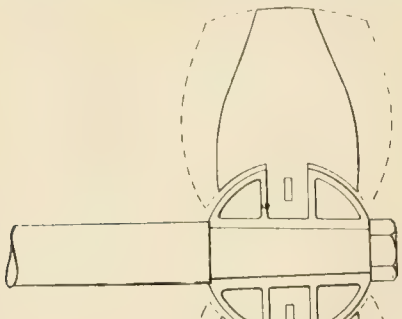


FIG 8
GRIFFITHS PROPELLER
OF 1849

the honour of being the inventor and introducer of the screw propeller is due to Francis Pettitt Smith, almost as large a measure of honour is owing, too, to Robert Griffiths, inasmuch as his was the most successful propeller in its day, and the propeller that remains with us now is, to all intents and purposes, the child of Robert Griffiths's invention. It only remains to add that in his original patent he proposed to fit the propeller blades into the boss with cylindrical shanks to admit of them being turned on their axis, so as to vary the pitch when required. He likewise proposed an arrangement whereby these propeller blades would automatically change their pitch to suit the varying conditions under which they were working; this, however, while being ingenious and interesting, was utterly impracticable, except in models or with very small ships.

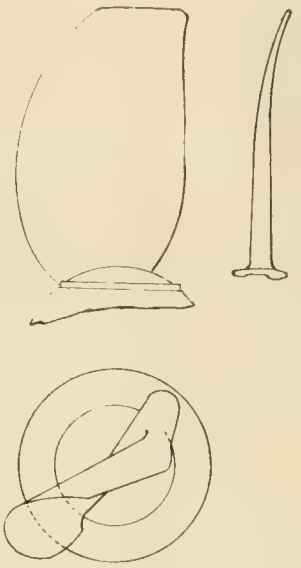


FIG 9
GRIFFITH'S PROPELLER

Fig. 8 shows the arrangement and form of propeller as proposed by Mr. Griffiths in 1849. From 1850 to 1860 the Admiralty experimented with this propeller in various ships, testing it against the "common screw," Woodcroft's increasing-pitch screw, modifications of the common screw, and sundry other propellers which were claimed by the inventors to have superior merits. At every competition the Griffiths propeller scored well, and it can hardly be said to have been beaten at any time. Fig. 9 shows the Griffiths screw as modified by him about 1860, and practically in the form in which it has continued until quite modern times. Mr. Griffiths laid down certain rules for the proportions of his screws and for ascertaining the dimensions of even the smallest part. It is sufficient, however, to state the following:—

Griffiths' Rules for Screw Propellers.

Diameter of boss to be from $\frac{1}{3}$ to $\frac{1}{4}$ the diameter of the screw.
Diameter of the flange of the blade to be $\frac{1}{2}$ the diameter of the boss.
Thickness of the flange of the blade to be $\frac{1}{20}$ the diameter of the boss.
Width of blade at widest part, $\frac{1}{3}$ the diameter of the screw.
Width of blade at the tip, $\frac{1}{7}$ the diameter of the screw.
Thickness of blade at root, $\frac{1}{16}$ the diameter of the screw.
Thickness of blade at the top. $\frac{1}{6}$ of that at the root.
Diameter of shank, $\frac{1}{4}$ the diameter of the boss.
The blades to be curved forwards to the extent of $\frac{1}{24}$ of the diameter of the screw at the tip.

It need hardly be said that the above rules apply only to two-bladed bronze propellers, as that particular kind best suited ships having sails and frequently using them instead of steam, such as naval ships cruising and making voyages where the coaling stations are wide apart, as in the Pacific.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

An Ancient Salvage.

A CORRESPONDENT has inquired as to the story of Cleopatra's Needle, and its eventful voyage from Alexandria. I believe that the obelisk, which now stands on the Thames Embankment, lay prone for centuries on the sands of Egypt till just thirty years ago. Originally there had been two such memorials; one of these was presented to the French and the other to the British far back in the nineteenth century. The French Government had lost no time in transporting their prize to Paris, though at huge expense. We, on the other hand, did not trouble to do anything in the matter. But in the seventies a well-known surgeon of the day found a sum of £10,000 for the purpose of removing the Needle to London. The monument, which was found to weigh about 187 tons, was encased in a cylinder something like a huge Cornish boiler. A bridge and signal masts were fitted to the structure, some 20 tons of railway iron were taken as ballast, and arrangements made with a steamer to tow the strange craft, which was 95 ft. long by 15 ft. beam, to the Thames. The time of year chosen for the voyage hardly seems to have been a good one, for it was in mid October that the little flotilla found itself entering the Bay of Biscay. Here a severe storm was encountered, and when 132 miles N.N.E. of Cape Finisterre, the master of the towing vessel came to the conclusion that there was nothing for him to do but to take off the little crew of the cylinder ship. This was safely accomplished, and the steamer continued to stand by in the hope of the weather moderating and so enabling him to resume the towage. But in the course of the night a serious misfortune occurred. A boat was put down for the purpose of returning to the cylinder ship, but owing to the heavy sea she was capsized, some six men being lost. This event naturally took the heart out of the survivors, and, not seeing any signs of the *Cleopatra* at daybreak, they assumed that the unwieldy craft had foundered, and they accordingly proceeded on their voyage.

On the evening of the next day, however, up came the *Fitzmaurice*, a small steamship by present-day notions. She was on her voyage from Valencia to Middlesbrough with a cargo of pig-iron. She at once made preparations to take the derelict in tow and eventually brought her into the port of Ferrol, at 9 p.m., on October 17th. The services she rendered occupied her some fifty two hours, and the distance towed was 93 miles, the obelisk ship having drifted into a position 90 miles N.E. of Ferrol after her abandonment.

I may add that the *Fitzmaurice*, which attained a handsome award for the services she rendered, did not complete the voyage to England with the Needle. She left the craft in Ferrol Harbour, whence it was towed to the Thames by one of Messrs. Watkins's tugs.

Launches.

September 20th, 1906, will ever be a memorable day in the history of British shipbuilding. For it saw some 74,000 tons of important steam shipping placed in the water. First there was the launch of H.M. armoured cruiser *Shannon*, built at Chatham Dockyard, then there was the *Mauretania*, at Wallsend-on-Tyne, and the *Adriatic*, at Queen's Island. Notes on these functions are afforded elsewhere in the current issue of this journal, so I will content myself with one observation on the matter. We should be entirely wrong if we assumed — as does the usually well-informed *Daily Telegraph* —that this fact proves the incontestible superiority of Britain as a shipbuilding country, and shows that we have greater resources than those of any other nation. The fact that these three ships took the water on the same day is the purest coincidence, as a glance at their several histories will show. The contracts for the two big Cunarders were given out to both Clydebank and Wallsend-on-Tyne in May, 1905. Yet the *Lusitania* was launched in June, 1906, and the *Mauretania* three months later, though I do not forget that there was considerably more weight worked into the Newcastle ship before she left the ways. The *Adriatic* was ordered from Messrs. Harland & Wolff as long ago as December, 1903, some seventeen months before the contracts for the great Cunarders were fixed. She is thus pretty well eighteen months behind the time at which she could have taken the water had her owners been in a hurry to take delivery. Lastly, the keel of the *Shannon* was laid in January, 1905, and the ship would have been launched in May had it not been for the fact that some damage was sustained by her stern bracket as she lay on the stocks. The true moral of the simultaneous launch of these ships would seem to be that many circumstances affect and delay the completion of vessels, and that it is not safe to rely that in all cases ships will be built in the period which on paper it would seem that their construction would occupy.

The Russian Outrages on British Shipping.

What one has long suspected has come to pass. The Russian Foreign Office has formally declined to grant any compensation for the sinking of the Liverpool steamship *Knight Commander* on the high seas, by the ships of his Imperial Majesty the Czar. The fact appears to be that the Supreme Court of the Russian Empire upheld the decision of the local Court of Vladivostock, which found that the *Knight Commander* was destroyed in accordance with the international rules of war. The Supreme Court having decided in this way, all legal methods of obtaining justice had been exhausted by the British shipowners and underwriters concerned, and they accordingly appealed to the British Government. The Foreign Office then asked the Russian State officials if they would, notwithstanding the finding of the Courts, reconsider the petition of the British shipowners and underwriters for compensation. This the Russians have declined to do. Thereupon our Government has asked that the Russians will accede to a suggestion that the matter be referred to the Hague International Arbitration Tribunal for adjudication. To this suggestion no reply has yet been received. Remembering that it was the Government of the Czar which, with its professed desire for the abolition of war, called the first Hague conference, it might be well supposed that there would be no escape from an assent to this request for reference. But the Russian desire for peace has been proved to be so hollow, and the position of the British Government with its absurd aspirations towards disarmament is so contemptible, that unless the Russians really believe themselves right on the facts, they will not mind whether they flout our Foreign Office or not. In spite of the heavy taxation which shipowners and manufacturers, amongst others, willingly endure for the provision of an adequate defence for this country and of their property afloat, it is abundantly clear that it will soon be recognised that in international matters it is a disadvantage to be under the British flag.

The New Route to Ireland.

Without any fuss or ceremony the Fishguard route to Ireland was duly opened on August 30th. The trains and steamships seem to have done all that was expected of them, and the chief need is passengers. It will, of course, take time to induce traffic to a new route such as this, and the unfortunate delay which, through no fault of the railway company, took place in the completion of the road to Fishguard, effectually shut the management out from any share in the tourist traffic of 1906. By the coming of the next tourist season, however, the Great Western should have not only got the service and its connections into perfect running order, but should have it thoroughly well known amongst the tourist classes.

It is part of the irony of fate that Fishguard being claimed as a fog-free route, there should have befallen it a fog —and a bad one at that—on the second day of its activity. Yet the fact remains that on August 31st the west-bound steamship ran into a fog not far from Tuskar and was kept eighteen hours behind her time. This incident speaks well for the master of the steamship, who might easily have been tempted to run risks to keep his time. But he thought of safety first. Still it is a pity that the third steamship was not on the station by the opening day, whilst anxiety would also have been lessened if the Marconi system of wireless telegraphy had been installed on the fog-bound vessel. For, as it was, when she steamed into Rosslare those on shore had been without news of her since she left Fishguard twenty-one hours previously.

Coincidences

are constantly noticeable by those who followed the affairs of the shipping world with attention. But seldom has a stranger coincidence occurred than the fact that the Pacific Mail Steamship Company's twin-screw liner *Mongolia*, bound to San Francisco with a very valuable cargo, including silk

and tea, should have stranded on Midway Island at the very time her sister, the *Manchuria*, was successfully floated from a reef at Rabbit Island, where, on her trip in the opposite direction, she had stranded in the latter half of August. Both vessels are safely afloat. But in each case important interests were involved and the damage to the two ships is, even as it stands, a serious matter enough. The two ships are but two years old, and of nearly 14,000 tons gross register. They were built at Camden, New Jersey, and are amongst the most important merchantmen ever built on the other side.

Another coincidence which I came across the other day was the fact that in one of the earlier months of the year no less than three steamships were added to the register in the United Kingdom under the name of *Evelyn*. They were entered at different ports, and were not vessels of the same class, but the fact that they were registered at all seems a further proof of the desirability of enabling the Board of Trade to prevent possible confusion by to some extent regulating the use of names in the Mercantile Marine.

German Competition in the Steamship World.

The month of September will be memorable for the fact that it saw announcements by the two great German steamship lines of substantial increases in their capital and thus in their activity. The Hamburg Line will raise £1,000,000 and the Norddeutscher Lloyd £1,200,000 additional capital for the extension of their fleets. The Lloyd is to have the monopoly—as far as these two companies are concerned—of speed on the Atlantic, whilst the Hamburg Company is to devote itself to the expansion of the slower passenger traffic with regard to which it has made so excellent a start with the provision of the *Amerika* and the *Kaiserin Auguste Victoria*. Apparently a couple of ships to run in a weekly service with these two vessels are to be added to this fleet. Then new ships are wanted for the development of the old Atlas service between the West Indies and New York, as well as on the main lines between Hamburg and Brazil, and Hamburg and the West Indies. The Persian Gulf service has also its calls for new steamships, as has the new line from the Mediterranean to South American Ports.

An extraordinary story has been published in regard to the alleged purchase of an American patent reversing turbine for a sum of £195,000 by the Lloyd Company. The inventor is said to be a mechanic employed in Milwaukee. One can hardly suppose that so hard headed a company as the Lloyd would pay in cash so large a sum for an undeveloped invention, though there is no doubt that patents appeal to their board, since they some time ago acquired an interest in the bulkhead door, which is known as the Stone-Lloyd patent.

Mails to the Far East.

Some little care must be taken by those who read of wonderful performances with the Eastern mails *viâ* Vancouver. An immense fuss has been made of the mail transit westwards by the *Empress of Ireland* and her connections. It would appear that the vessel in question left Liverpool on the evening of Friday, August 24th, and reached Quebec at 3 a.m. on the morning of August 31st. On September 4th Vancouver was reached by the special train bearing the mails and passengers who had gone through from her, and after but an hour's halt, were on their way across the Pacific on the company's steamship *Empress of China*. On September 16th they reached Yokohama on schedule time. This seems to promise that the undertaking of the Canadian Pacific Railway to get the mails through to Hong Kong will be fulfilled. If it were left at that we should admire the enterprise of the company and think it had done well enough. But that is as I have pointed out regretfully on more than one occasion in regard to the competition with the Allan Line turbines—not the way of the C.P.R. They must claim rather more than is their due. They do not realise the fact that mail transit to Hong Kong by the Suez route still beats this achievement. Yet the fact remains. The course of post *viâ* Suez is but 27½ days, thus beating them on paper by two days. But in point of fact the P. & O. Company does not occupy the full time allowed by its contract, and thus it often does the journey in under 26 days. So, when all is said and done, there is still 3½ days to be knocked off their performance by the Canadian Pacific service. The *Times* of September 22nd contains a statement, evidently emanating from inspired sources, which implies that the mail time *viâ* Suez is 40 days. I have already stated the facts here, so that none of my readers need be deceived in this matter.

The Hong-Kong Typhoon.

A terrible disaster has befallen the port of Hong Kong. From the news at present to hand it would appear that the British war steamer *Phœnix*, an obsolescent sloop, was wrecked whilst the river gunboats *Moorhen* and *Robin* were damaged, as was the destroyer *Taku*. Two French warships, the *Fronde* and the *Francisque*, both destroyers, were also affected, the former being apparently lost. The Canadian Pacific Railway had two steamships in the harbour. Of these, one, the *Empress of Japan*, sustained no damage, whilst the *Monteagle* went ashore, and, though floated, suffered a broken stern. The *Coptic* is damaged forward. The British steamer *Strathmore* and the German steamer *Quinta* were damaged by collision. The British river steamer *Fatshan* was in collision with the French mail steamer *Polynesian* and was afterwards beached. The *Radnorshire* seems to have been fouled by the *Monteagle* before the latter went ashore. The German steamer *Sullberg* sank alongside the Kowloon Dock as the result of a collision. The Dutch steamer *Tijilwong* whilst at anchor was run into by the German steamships *Devawongse* and *Emma Luyken*. The small German steamer *Apurado* seems to be a total loss, so are the British steamers *Heungshan*, *Fatshan*, and *Kong Nam*. The *Kinshan* is ashore, but resting easy. The *Chinkai Maru* is badly damaged, as are the *Petrarch*, the *Signal*, of Kiel, the *Johanne*, and the *Mathilde*, of Kiel. The British steamers *Albatross* and *Perseverance* are both sunk. But the damage to shipping, serious as it is, is but a part of the loss, for hundreds of lighters were destroyed, and the amount of cargo, both inward and outward, damaged in this way will be immense. The loss of European life involved does not at present seem very great, though it seems certain that the Bishop was lost through the swamping of his launch as he returned from a missionary tour.

The Port of London.

A very able contribution to the discussion of this important question has been furnished by Mr. Alexander Wilson, a well-known commercial solicitor of Liverpool. He points out that admittedly nothing has been done for the modernisation of the Thames docks during all these years when the Mersey Dock Board has been spending millions in the adaptation of its facilities to modern requirements. The good directors of the London and India Docks have devoted their energies simply to the question of doing the best for their shareholders in the forced sale which they foresee. So the docks have been starved, a larger return than before has been squeezed out of them for dividends, and the market price of the stock has been forced up. This is excellent for shareholders, and it is the shareholders whom the directors have to consider. But under such circumstances, buying obsolete and starved plant, it were absurd for the public to come in at inflated prices, and so Mr. Wilson points out the danger and expense of allowing the vendors to have guaranteed stock for their holdings. He also gives excellent reasons, if they were needed, against allowing the London County Council to have any voice in the management. That must rest in the hands of business men, as it does in Liverpool.

Index for Vol. XXVII. will be published in our next issue.

Mr. Edward Hayes, Watling Works, Stony Stratford, has lately received orders for steam tugs, launches, and their machinery from the following places: Persia, Siam, Brazil, Spain, Jamaica, River Plate, and the Red Sea.

The Worthington Pump Company, Ltd., with which is incorporated the European business of the Blake and Knowles Steam Pump Works, of 153, Queen Victoria-street, London, E.C., and Newark-on-Trent, have issued a new edition of their catalogue, entitled "Blake Marine Pumps and Specialties." This catalogue is very extensively illustrated not only with photographic reproductions of various types of pumping mechanism manufactured by the firm, but also with sectional drawings with schedule of parts, numbered relative to reference numbers on the drawings themselves. These are not only very instructive as far as the understanding of the mechanism is concerned, but enable duplicate parts to be readily ordered by any owner of plant who requires replacement of either worn-out or broken mechanism.

moval of shafts are provided. Special attention has been given to the blading of the *Mauretania's* turbines. The blades vary in length from 2½ in. to 23 in., and the Willans & Robinson method of fixing has been adopted. Instead of each blade being put in separately with a packing piece and caulked, the circles of blading are built up in segments, which are afterwards wedged into grooves in the rotors or casings. In addition the upper parts of the blades are fixed and laced in accordance with the usual Parsons' practice.

In prime movers containing rotating masses weighing scores of tons, with peripheral speeds as high as 11,000 ft. per minute, running in practically steam-tight contact with stationary portions of the structures it is obvious that only great nicety of adjustment can secure efficiency and safety in working. In the *Mauretania's* turbines the greatest care has been devoted to the thrust block adjustment gear for taking up the running clearance of the dummy. The upper cover is independent of the lower, and the thrust collars bear on the top half on the forward side, and on the lower half on the aft side. The cover is fitted with adjusting screws, by means of which adjustment of the running clearance may be effected as required. The thrust shaft has deep collars with oil grooves in the thrust shaft itself, an arrangement which should give a satisfactory distribution of oil. The shafting for the low pressure turbines is about 33 in. in diameter, and for the high pressure ones about 27 in. in diameter. The shafts transmitting the power to the four propellers are all 20 in. in diameter, and all the shafts are made hollow of Whitworth special steel.

Steam is supplied to the turbines from twenty five boilers, two of which are single ended, the others being double ended with eight furnaces each. They are 21 ft. long and over 17 ft. in diameter. They will be contained in four stokeholds, six boilers being held in three of these, with seven in the forward stokehold. The steam generators will have a combined heating surface of 160,000 sq. ft., and a grate area of nearly 4,000 sq. ft. Air will be supplied to the furnaces by Howden's Improved Forced Draught system, the fans being electrically driven. From each of the four groups of boilers an elliptically shaped funnel, measuring externally 23 ft. 6in. by 17 ft. 6 in. will rise to a height of 152 ft. above the keel of the ship. The steam pressure at the boilers will be 180 lb. and 160 lb. at the turbines. Nearly the whole of the interior surfaces of the double bottom, fore and aft, has been coated with Wailes, Dove & Co.'s patent bitumastic enamels, also the bilges and interior surfaces of bunkers, the tank tops in turbine, boiler, and machinery spaces have been coated with patent bitumastic covering. The subsidiary appliances in the engine and boiler departments will be of a most complete and interesting character, and these, together with particulars of the unequalled passenger accommodation provided for all classes, will be fully dealt with when the fitting-out of the ship is further advanced.

The *Mauretania*, as stated at the commencement of this article, will be available in case of need as an armed cruiser or scout. For this purpose she will be fitted with twelve quick-firing guns, and the coal bunkers are arranged to give protection to vital parts. Furthermore, the rudder and steering gear are placed entirely below the water line.

Engineering and Machinery Exhibition.—The following lectures have been arranged for delivery in the lecture hall at Olympia during the term of the above Exhibition: — Saturday, September 29th, at 7 p.m.: "Development of the Steam Turbine." The Hon. C. A. Parsons, M.A., C.B., and R. J. Walker, Esq. Saturday, September 29th, at 8 p.m.: "Sanitary Science as applied to Marine Engineering." A. E. Battle, Esq. (Member of Royal Sanitary Institute). Monday, October 1st, at 8 p.m.: "Master Strokes of the Great Engineers." J. C. W. Haldane, Esq. Tuesday, October 2nd, at 8 p.m.: Popular lecture. "Japan and the Far East." George A. Goodwin, Esq., M.Inst.C.E., A.M.Inst.E.E., Whit Sch., Past President of Society of Engineers. Thursday, October 4th, at 8 p.m.: "Gas Engines." H. A. Humphrey, Esq., F.C.G.I., M.I.C.E., M.I.Mech.E., M.I.E.E. Tuesday October 9th, at 8 p.m.: "The Connecting and Disconecting of the Power from the Work." Dr. H. S. Hele-Shaw, F.R.S., M.I.C.E., M.I.M.E. Thursday, October 11th, at 8 p.m.: "Gas Engines" (second lecture). H. A. Humphrey, Esq., F.C.G.I., M.I.C.E., M.I.Mech.E., M.I.E.E. Monday, October 15th, at 8 p.m.: "Steam Pipes and their Explosions." C. E. Stromeyer, Esq. Many of these lectures will be illustrated by lantern views, diagrams, &c.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondents at home and abroad.)

New Warship Construction.

AN interesting comparison between the relative rates of construction of the great naval Powers recently appeared in the "Cologne Gazette," and the conclusion is arrived at that, while France and the United States have not put forth sustained efforts in the execution of their naval programmes, Great Britain and Germany have advanced with continuity and punctuality. Thus, in England, the ships of the 1903 programme, which include three battleships and four armoured cruisers, are now nearing completion. Of these, the battleships *Africa* and *Britannia* have just carried out their trials, while the *Hibernia* will begin hers in a day or two. The four cruisers, *Cochrane*, *Natal*, *Achilles*, and *Warrior*, are in a similarly advanced stage. Of the German ships set down in the corresponding programme, the battleship *Lothringen* and the cruiser *Yorck* finished their respective trials in June and March, while the battleship *Deutschland* has recently carried out hers. Of the British 1904 programme, which includes two battleships and three cruisers, as compared with Germany's two battleships and one cruiser, the battleships and two cruisers have been launched. The German vessels are expected to be launched before the end of the year. The circumstances in which the *Dreadnought* has been built are regarded as exceptional, and are, therefore, discounted. But the rapidity with which the one battleship of the British 1905 programme has been constructed is somewhat compensated by the fact that the three cruisers of the "Invincible" class were laid down late in the financial year. Against these four vessels have to be set the two battleships and one cruiser of the German programme, all of which are under construction. Moreover, it is believed that the British and the German new constructions for the current year are also advancing side by side. From these circumstances, it is confidently inferred that Germany, "thanks to the productive capacity of her shipbuilding industry and the consistent uniformity with which the naval authorities engage its services, has, to say the least, been able to keep step with England in every department in the execution of her naval programme."

Sheerness Dockyard.

It was announced, about the middle of September, that the Admiralty, having had under consideration the wages votes for the several dockyards, had decided to increase the amount for this yard by £3,200, and for Chatham by £24,000. This will make the vote for the financial year ending March 31st next for Sheerness £99,001, and for Chatham £436,503. The Admiralty directs that these amounts are not to be exceeded, and that overtime and casual labour are to be reduced to a minimum. Needless to say, this announcement has given great satisfaction. The condition of affairs here appears more settled than it has done for some time past. Every branch now seems to have its fair share of work, and there is every reason to believe that this will continue. The yard will be in a much better position when the work of extending Nos. 4 and 5 Docks is completed; but some time will elapse before they are available for destroyers. The electrification of the yard has been taken in hand. The foundations for the generating station had been put in before the scheme was temporarily abandoned, and, with its resuscitation, the building for the plant is in course of erection; and the Admiralty have also arranged with the Westminster Engineering Company to carry out the wiring of the system. Some extra work has come here by the return of the surveying vessel *Goldfinch* from abroad for a refit. It was at this yard that the vessel, after serving several commissions on the Australian Station, was fitted out as a surveying ship about five years ago. There was no delay in taking her in hand, for she was placed in the steam basin on September 1st, the day after her arrival. It was at first thought that she was going to Chatham. The sloop *Merlin* is again flying the pennant, for she was commissioned on September 5th by Captain Parry, who superintended the work of fitting her out for her new duties as

surveying vessel on the China Station, where she is to take the place of the old gun vessel *Rambler*, which is now laid up at Hong Kong. The *Merlin* has had her rig altered, one of her masts being dispensed with, and she has been fitted with appliances suitable for her new duties. She will probably leave about the middle of next month. The Captain Superintendent alarmed us at the beginning of the month by directing the alarm bell to be rung in the morning during working hours in order to test the arrangements for coping with fire. It is many years since the bell was rung during working hours for such a purpose; but everything went off all right, to Captain Startin's satisfaction.

The Brennan's Torpedo Factory.

It is stated, on good authority, that Brennan's torpedo factory at Chatham is to be practically shut down before long. It is interesting to recall the fact that the first Brennan torpedo was made in Chatham Dockyard about twenty-five years ago. A factory was established close to the Pembroke gate, and when this land was required for the erection of the naval barracks ten years since, the factory was removed to its present home. The War Office paid a large sum for the exclusive right to the use of these torpedoes, and at two or three points on the coast for some years past Brennan's torpedoes have been relied upon mainly to defeat a naval attack. Large stocks of the projectiles have consequently accumulated in recent years. Now that the coast defence has passed over to the care of the Admiralty, the Government have come to the conclusion that they have in stock sufficient of these torpedoes to meet all reasonable requirements, so that for the present their manufacture will cease. "The Brennan torpedo," says the "Army and Navy Gazette," "has been a very expensive toy, since the time when it was acquired by the War Office at a cost of £110,000, with a salary to Mr. Brennan, the superintendent of its manufacture. It has been the subject of much costly experiment, and installations of the machinery required for its manipulation are to be found at a few places at home and in our Colonies and Dependencies. But we have never yet heard that it is likely to give a satisfactory return for the outlay, or to exercise a deterrent effect, moral or otherwise, upon the action of an alert and enterprising enemy. It was purchased at a time when local and fixed defences were much more in favour than they are at present, and it has never been regarded with a partial eye by our Navy. Yet, curiously enough, it was a committee mainly of naval officers that first advised its being sent to this country for examination by the military authorities. It was then thought, however, that it might be utilised as a naval weapon; and it is because it labours under the disadvantage that it cannot be taken to the enemy, that it has been held in such small esteem by seamen. Doubtless, the factory can be used for other purposes than the manufacture of the torpedo; but we are assured that nobody will regret the disappearance of the Brennan from our national armoury."

Chatham Dockyard.

The battleship *Africa* returned from her trials on August 31st at the very hour fixed. The rumour that her trials had to be postponed owing to defects having been discovered at Portsmouth was without foundation, for her stay at Portsmouth was arranged in the original programme, so as to give the gun-mounting party an opportunity of drilling with her guns before the gun-mounting tests took place. Both machinery and gun trials were most successful in every respect; and in less than two months she will be passed into the Navy, ready to be prepared for her maiden commisssion, which will probably be in the Channel Fleet in place of the *Victorious*. During the trials, the machinery, which was supplied by Messrs. J. Brown & Co., worked smoothly, and no difficulty was experienced in getting the stipulated power and the corresponding speed. The gun trials passed off equally well; and, thanks to the excellence of the work in connection with the gun-mountings, there was not the least hitch. The gunnery experts were fully satisfied. The *Africa* has an armament of four 12-in., four 9·2-in., and ten 6-in. guns, as well as twelve 12-pounders and a similar number of 3-pounders. She is the biggest vessel turned out here; and nothing would give us more pleasure than to be allowed to build a few more of the same sort. But it is evidently not to be. The drop from battleships to lighters is, however, a big one, and one by no means relished. As to the submarines, very little has been done in the way of preparation for that work, the result being that rumours are afloat that the decision to build them here will probably be reversed. The cause of the delay, however, is believed to be due to the fact that considerable improvements are anticipated in the construction of submarines. At any rate, the financial year is half gone, so it is certain that only a small amount will be spent on the boats during the present year. This is to be regretted, for the programme of new construction is quite small enough. The cruiser *Shannon*, which was launched on September 20th, is in a far more advanced stage than the majority of vessels which have been launched at this port. Much of the machinery has been delivered by the contractors, Messrs. Humphrys, Tennant & Co., Deptford, and the work of placing it in position will be commenced shortly after the vessel is placed in dock, for she is quite ready to receive it. A fuss was made in some quarters as to a fire which broke out in the vessel about a week before she was launched. It appears that the fire occurred in one of the engine-rooms, and it was caused by the spontaneous combustion of some cotton-waste. The damage was trivial, the fire having been discovered almost immediately; but, of course, an inquiry had to be held.

Devonport Dockyard.

Reports of quite an alarming nature reached here at the beginning of the month as to the discovery of "scamped" work on the wrecked *Montagu*. The wonder is, if there were any foundation for the reports, why the vessel has not fallen to pieces before now. To my mind, it is a proof of the sound manner in which the vessel was built that she has stood such an amount of buffeting. It seems to be the fate of almost every vessel in the Navy at some time in her existence to have the same thing said of her. The *Montagu* was built here when Mr. George Crocker, C.B., was civil technical assistant to the Admiral Superintendent, and Mr. Champness, the present assistant director of naval construction, was chief constructor. The fact that these distinguished members of the Royal Corps of Naval Constructors were here while the vessel was being built should be a guarantee that she was constructed in a workmanlike manner. The cruiser *Minotaur* was placed alongside No. 1 Jetty on September 13th to enable the armoured ammunition trunks and barbettes for the 7·5-in. guns, and the main condensing and auxiliary machinery, to be placed on board. The armoured trunks are in two lengths. The main portion, extending from the edge of the upper deck to below the armoured shelf, is of 7-in. hardened steel, and weighs about 14 tons. The other length of the trunk is recessed into its lower edge, and extends to the crown of the shell-room. The barbette armour is in sections, each weighing about 5½ tons, and when assembled they will be secured together by vertical T-shaped keys. The main condensers each weigh about 17½ tons, and they are supplied complete in all details. The cruiser *Argyll* was undocked on September 8th, after having her propeller shafting readjusted, her propeller blades tested with weight pressure, and her under-water fittings overhauled. Her funnels were subsequently removed and sent to Keyham Factory for repair. Armour gratings have been fitted to the funnel casing, the *Argyll* being the first vessel of her class to be thus supplied. A new set of Babcock & Willcock's water-tube boilers is also to be manufactured for the vessel. The condition of the funnels has drawn attention to a weakness which has developed in the construction of our latest war vessels, due mainly to a desire to reduce the weights carried. The thickness of the casing has been fixed at 3-32nds of an inch, and the funnel proper at 3-16ths of an inch. These thin funnel plates, when exposed to the fierce heat generated by water-tube boilers at high speeds eventually erode; and, if they were exposed continually, as they probably would be in actual war, they would become a source of danger as well as weakness to the ships carrying them. I understand that the question of increasing the thickness to a quarter of an inch is now receiving the attention of the Admiralty. The cruiser *Blake*, the depôt ship of the Reserve Destroyer Flotilla, was placed in No. 3 Dock in the South Yard on September 14th. Her upper deck fittings are to be removed, and she is to be fitted with workshops, in which repairs to destroyers will be made when away from port. I hear that the battleship *Hannibal* will have to be docked again, it having been discovered that the propeller shafting is out of alignment, and it may have to be taken out for readjustment.

Interesting Speed Trials.

Two interesting speed trials have recently been carried out. One took place during the run of the Channel Fleet from Invergordon to Portland, the other being the run of the Second Cruiser Squadron from Ireland to Gibraltar. On

August 28th, after clearing Cromarty Firth, the ships of the Channel Fleet were ordered by Vice Admiral Sir A. Curzon-Hoare to form single line abreast, and work up for a full-speed trial. The dropping of a ball from the yardarm of the flagship *Caesar* was the signal for the trial to commence. As soon as the ball had dropped, the *Albemarle* (flagship of Rear-Admiral Groome) took the lead. She was followed by the *Ocean*, which at first made a good show; but at 6 a.m. on the following morning reported "broken down; unable to steam more than ten knots an hour." The cruisers *Juno* and *Dido* were next, followed by the *Caesar* and *Goliath*. The latter battleship, on paper, is a much faster ship than the *Caesar*, but, in practice, did not prove so. The *Prince George* brought up the rear, but she is due for her annual refit shortly. The *Ocean* arrived last, but the ships maintained the above positions until their arrival at the rendezvous, off St. Catherine's, Isle of Wight. A feature of the twenty-four hours' steam trial of the Second Cruiser Squadron between Ireland and Gibraltar was the performance of the *Cornwall*, which left the *Drake* (flagship of Prince Louis of Battenberg), hitherto the best steamer in the squadron, about fourteen miles astern. The squadron, consisting of the *Drake, Cornwall, Berwick, Duke of Edinburgh*, and *Black Prince*, left Tarbert, in the River Shannon, on the morning of Saturday, August 25th. At 1 p.m. the eight hours' full-power trial and sixteen hours' 3-5ths power commenced. By 3 p.m., the weather had become thick, with a heavy head sea. The *Drake* and *Cornwall* were then ahead, and out of sight of the remainder. Later, the *Berwick* developed engine defects, and abandoned the trial, proceeding to Gibraltar under easy steam. The average speed per hour for the eight hours' full power trials were: *Cornwall*, 23·8 knots; *Drake*, 23·2; *Duke of Edinburgh*, 22½; *Black Prince*, 20·5. The squadron then formed up about 35 miles W.N.W. from Finisterre, and proceeded under easy steam to its destination.

Portsmouth Dockyard.

The *Dreadnought* completed coaling on September 13th, she having taken into her bunkers 1700 tons of best hand picked Welsh steam coal for her trials. The coaling took place from the lighters, while the vessel was alongside the basin under the large shears. The auxiliary machinery and the hydraulic gear on board have been tested, and the vessel will go out on October 1st for her steam trials. Messrs. Armstrong's men have been submitting the guns and berthes to the usual preliminary tests and examination. The *Good Hope* and *Duncan* will have their repairs completed shortly, and when the *Dreadnought* is out of hand, the 3,000 men now employed on her will require other work. There are several destroyers and torpedo-boats in the port, but their repairs are chiefly carried out by naval artisans belonging to the ships, or by others sent from the repair ship *Hecla*. When our new vessel is started, employment will be found for a considerable number of shipwrights and riveters; but even then there will be a dearth of employment. The trades union conditions come into force on October 1st, and probably the difficulty will be met by compelling the men to "stand off." This feature the dockyard men are looking forward to with some uneasiness. The old battleship *Colossus* on September 8th was relieved as sea-going tender to the Gunnery School by the *Revenge*. That vessel is of the "Royal Sovereign" class, and she is a much more suitable vessel for training purposes than the *Colossus*. That battleship is to be sold out of the service. She has long been considered too old fashioned even for training purposes, and it is a wonder that she has been used for so long. The selection of Rear-Admiral C. G. Robinson to succeed Sir Henry Barry is very popular. The gallant Admiral is well known here. He was at one time captain of the *Vernon*, and he knows the yard and its workings intimately. He will, no doubt, make a very good Admiral Superintendent, as he has always borne a reputation for showing great consideration for his subordinates. I understand that Rear-Admiral Spencer Login was selected for the appointment, but something occurred which caused a change to be made; so he goes to the Reserve Division, in succession to Rear-Admiral Cross. The new electricity generating station was formally opened by Sir Henry Barry on September 15th. In addition to supplying the power for the whole of the dockyard, the new station will eventually supply the current for the Gunnery Establishment at Whale Island and the Royal Naval Barracks. The outside works are as yet incomplete, but when finished, a very large amount of the machinery in the yard will be run by electric power.

Pembroke Dockyard.

A letter was received by the Chairman of the Pembroke County Council at the beginning of the month from the Admiralty on the future of this yard. It contained a most satisfactory announcement. It pointed out that the question of the future maintenance of the yard as a naval shipbuilding establishment had for some time past been engaging the attention of the Admiralty, who did not at present anticipate a reduction in the number of men borne at the yard during the financial year 1907-8. A new ship would be laid down at the yard early in the financial year. The statement that there will be no anticipated reductions is interpreted to imply that within the period named it will not be necessary to discharge hired men to make room for apprentices, as was done recently. It is also taken for granted that the men who went to Gibraltar in January last to repair the *Assistance*, and who were recommended to volunteer for Devonport or Portsmouth, instead of returning here, will not now be sent to these yards. Fifty three of the men returned home on September 8th, and the remainder are shortly expected. The *Warrior* is fast nearing completion, and I hear from Portsmouth that the crew of the cruiser *Cressy*, which vessel belongs to the Reserve Division at that port, has been told off to man the *Warrior* when she carries out her trials. The same crew will commission her about next April, so they will be quite familiar with their new ship by then. There is a peculiarity about the masts of the *Warrior* which will probably be an eyesore to seafaring men. Instead of carrying the topmasts immediately before the standing masts, they will be attached to the after end of the two platforms some distance abaft the standing masts. This change was necessitated by the arrangements incidental to the fitting of the fire-control platforms at the head of the standing masts, and close above the electric search-light platforms at the cross-trees. Our Captain-Superintendent has been promoted to flag rank sooner than was expected, but he will remain until October 1st, as originally intended. Captain Denison's promotion is due to the death of Rear Admiral Sir Edward Chichester at Gibraltar on September 17th. When Captain Denison leaves us, he will do so with the good wishes of all here for his future prosperity, for he was exceedingly popular with both the officers and men. The operations for removing the guns of the wrecked *Montagu* appear to be going on successfully, for two of her 12 in. guns have been got off and sent to this yard.

CORRESPONDENCE.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

Re Monthly Publication.

[*To the Editor of* The Marine Engineer and Naval Architect.]

Gentlemen, I wish to acknowledge the receipt of copies of the Marine Engineer—No. 24, also current number (August 1st)—which, I note, inaugurates a new monthly series. In consequence of their receipt, I beg leave to retract my letter of August 16th, in which I made complaint relative to the irregularities of the receipt of certain numbers of the magazine, which I now discover had never been issued. The lack of opportunity for perusal of the editorial page in connection with the non-arrival of those apparently due, occasioned the despatch of my letter, which the announcement in the current issue now renders void.

It is with satisfaction that I observe the reversion to the original plan of monthly publication—a plan, as you say, admitting of more wholesome digestion of technical matter than could possibly obtain under the policy of weekly editions. It is especially commendable that you realise the importance of catering to the younger intelligence; and the fact that this is to be an integral part of the future magazine, I trust, may be the means of enlarging the scope and value of your esteemed publication.

May the success that has attended the Marine Engineer of the past attend your endeavour of the future, and with best wishes. Believe me, respectfully yours,

Arthur R. Bush.

Boston, Mass., U.S.A.
August 24th, 1906.

THE "LORD NELSON."

H.M. battleship *Lord Nelson*, of which we give a full-page view, was launched on September 4th, from the works of the Palmer's Shipbuilding & Iron Co. Ltd., of Jarrow-on-Tyne. She is a sister ship to the *Agamemnon*, and was designed by Sir Philip Watts almost immediately upon his appointment to the Admiralty as Director of Naval Construction. The dimensions, &c., of the vessel are: Length (between perpendiculars), 410 ft.; breadth, 79 ft. 6 in.; draught, 27 ft.; displacement, 16,500 tons; H.P., 16,750; speed, 18 knots; maximum coal capacity, 1,800 tons; armament, four 12 in., ten 9·2-in., and twenty small guns; cost, £1,616,083; armour—the belt is 12 in. in thickness amidships, tapering to 6 in. at the bow, and to 4 in. aft; above this the armour is 8 in., right up to the upper deck; forward and aft there are the usual bulkheads, which are also of 8 in. armour; within them are located the barbettes, which are for the most part of 12 in.

The propelling engines are of the standard British Admiralty type, having four cylinders working on the triple-expansion system. The high-pressure cylinders in each set of engines are 32¾ in. in diameter, the intermediate 53¾ in., the low-pressure cylinders 60 in. in diameter, the stroke in each case being 48 in. The engines take steam at an initial pressure of 250 lb., the working pressure in the boilers being 275 lb.

ELECTRICITY ON BOARD SHIP.

I.

By Sydney F. Walker, R.N., M.I.E.E., Assoc.M.I.C.E., &c.

As in every other industry, electricity is now making its way on board ship, but the struggle has been a long and severe one. There has been no question of advancing by leaps and bounds. Each advance that has been made has been the result of hard work, careful thought, and continuous sticking to, by those who have pioneered the work. The conditions present on board ship are the most severe that electricity has to encounter. In electrical work there are two principal agencies that make its development hard, and that causes trouble to those who look after the apparatus, viz., vibration and wet. The vibration of the ordinary well built house or factory, due to the traffic in the roads the buildings border, and to the motions that are more or less always present in the earth's crust, are sufficient to lead to troubles of various kinds. Many a telephone trouble has been caused by the flick of a housemaid's duster, following a period during which a wire had been exposed to the ordinary vibration to which every house is exposed. On board every ship, the vibration of the main engine is ever present, and is unavoidable, and it is a great many times more severe in its effect than the most troublesome vibration that is met with on shore. In addition to this, also, which may be considered as the everyday condition of a ship at sea, there is the working of the ship in a sea-way, and the special and particular motions of the parts of the ship which it gives rise to, which are all transmitted to any electrical apparatus that may be fixed in the ship. Water of all kinds is another very bad enemy of the electrical engineer. Many a trouble has been caused by an apparently small drop of water that has condensed on the cold surface of a wire, through which an electric current was passing, or was intended to pass; and, again, when the water is impregnated with salts, such as those always present in sea water, the effect is very much increased. Electrical apparatus is full of what electrical engineers call "connections"—points at which the current passes from a wire or cable to a terminal, to a mass of metal, to another wire—and so on; and these points, where connections are made, are the points to which the vibration of the engines, and of the ship, and the sea-water, or the salts that are deposited from it, tend to bring trouble. Many connections are made by bending a wire or cable round a screw, and tightening the screw up; in other cases, connections are made by pushing the bared end of a wire or cable into a hole in a mass of metal, and tightening a screw up upon it. With other connections, such as those to the commutators of continuous-current dynamos, wires are soldered together, and to pieces of metal, to which they are to transmit the current. In all these cases, and others, vibration tends to loosen the connections, and water, if it is present, tends to set up electro-chemical actions, eating away some of the wire or metal, and gradually destroying the connection between the two. And this is not the whole story. When a connection between a metal and a cable is shaken loose, sparking takes place between the loose metals, if other conditions are favourable; and often an arc, as electrical engineers call it, is set up, similar to that with which marine engineers are familiar in the arc lamp, but very destructive in its operation. The arc, when formed, creates an intense heat, some thousands of degrees Centigrade, with the result that substances in its immediate neighbourhood are seriously damaged, and particularly insulating materials. Insulating materials, which are of such enormous importance in connection with electrical work, are mechanically very weak; few of them can resist high temperatures, and they are the bane of the engineer's life generally. An arc formed in the neighbourhood of any insulating material destroys it in a very short time. When the electric incandescent lamp was first introduced, it was seen that it was the very thing for use on board ship; but some of the troubles that have been mentioned above immediately arose. The ordinary capped lamp, fitting in its lamp-holder, with plunger contacts, was a frequent source of trouble, and for a long time in the English Navy it was the common practice to form two hooks on the ends of the wires conveying the current to the lamp, and to hook the lamps to them by means of the platinum loops that were used in the early lamps, it being found that the flexible connection so formed stood better, under the vibration of the ship, and its knocking about in a sea way, than the comparatively rigid connection of the capped lamp and its holder. Again, cables for a long time were a great source of trouble. Many ships have to pass through different climates with very short intervals of time, a comparatively few days, in some cases, taking the ship from tropical heat to the low temperatures of temperate winter, and some of the insulating materials would not stand the change. Other insulating materials employed for cables would not stand salt water. In the case of men-of-war, also, considerable difficulties arose in carrying cables through the watertight partitions. Again, in the early days of electric lighting the engines and dynamos, even on shore, were not all that could be wished; and certainly they were not capable of withstanding what often came against them in the engine-room of a steamship. When the steam turbine was first introduced in 1887, it was hailed as the thing for generating current for the lighting of steamships. It occupied a very small space, it required practically nothing in the way of foundations, and apparently it required little attention. Yet the writer believes that there is not a single steam turbine that was fitted on board ship in those days, in use at the present time. It is not surprising, therefore, if the later developments, the adaptation of the electric motor to driving winches, capstans, hoists, &c., took a considerable time in developing. It was shown a good many years years ago that the steam winch was a very wasteful machine in the matter of steam; but it was replied, with justice, it did its work. It could be depended upon to load or unload a steamer without stopping. It would stand all the rough weather to which the steamship was exposed, and be ready for work on arrival in harbour with a very little attention; whereas it was at that time very doubtful indeed whether the bulk of the engineer's time would not be spent in coaxing an electrically driven winch to work under the most favourable conditions. Notwithstanding all this, however, electricity has made its way, and is now adopted in all the large steamship lines for a large portion of the work, for the lighting of the ship generally, for search lights, for lights for discharging and loading cargo, for capstans, winches, boat-hoists, &c. It has also forced its way into the man-of-war, and is gradually displacing hydraulic machinery, notwithstanding the undoubted convenience and flexibility of the latter, for loading and training guns, for

It will be gathered that machine tools are a very prominent feature of the exhibition, though a large number are of foreign make. It only remains to say a Reavell engine was being used to drive the machinery, and this had a prominent central position in the hall. The length of machinery exhibited is said to be 1,350 yards and the weight about 4,000 tons. This will give some idea of the extent of the display.

THE NEW "HEZZANITH" STANDARD BINNACLE.

As time goes on improvements are made in the details of construction, and new combinations of parts are arranged in order to increase the scope of operation and the efficiency of scientific instruments, and in no class of type of apparatus is this more marked than that of magnetic devices for use on shipboard. We have pleasure in describing and illustrating the latest type of standard binnacle and compass which has been put on the market by Messrs. Heath & Co., Ltd., of Crayford, London.

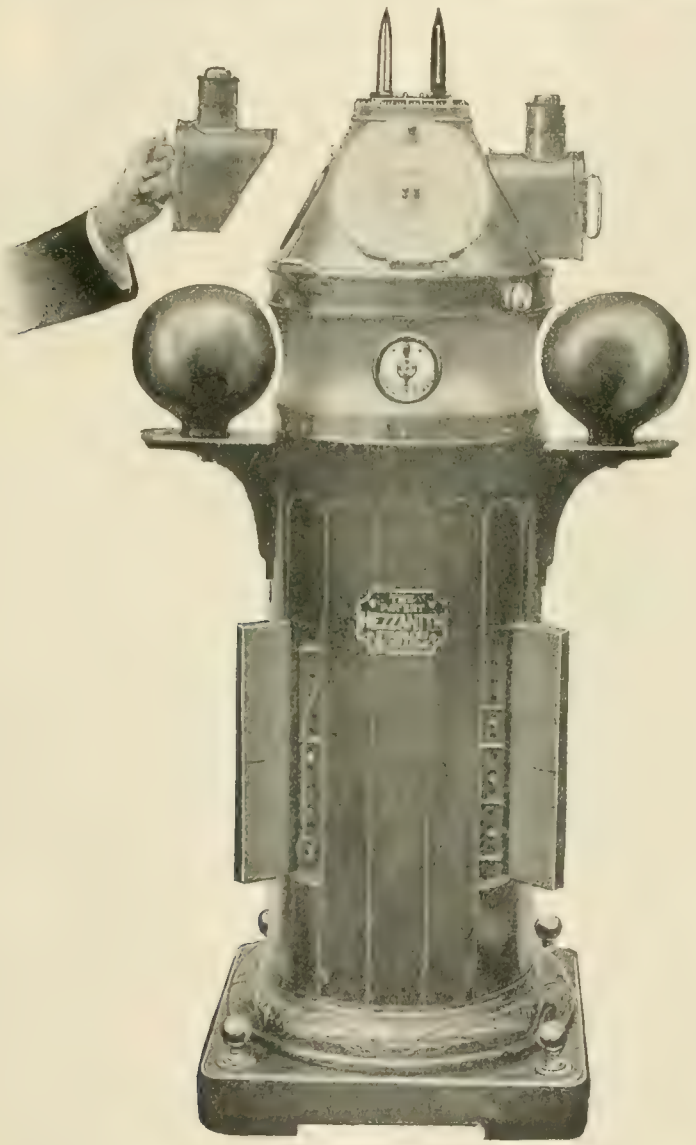


Fig. 1.

Fig. 1 of the adjoining illustrations indicates the general outline of the apparatus and the sighting arrangements on the sides and upper part of the conical binnacle top; and

Fig. 2 shows in some detail the improvements in the Azimuth instrument which we will refer to hereunder.

With reference to Fig. 2, it will be noticed that the compass is swung on horizontal helical springs, A. This is effected in an entirely novel manner, and so arranged that the ends of the springs have no wear and tear, thus avoiding the breakdowns so common at present; in fact, it is claimed that the springs will now last as long as the binnacle itself. The journals of the compass and the gimbal are provided with a special device, K, so arranged that, while the compass can be removed from the binnacle easily, it cannot by any sudden lurch of the vessel be unshipped from its proper position.

When it is necessary to move the compass bezel to reach the card, point, or cap, it can be done by simply

turning two milled heads, B, fixed on either side of the compass bowl, thus avoiding the use of screws which may become undone or be lost.

There is no glass bowl to the bottom of the compass, but a dependent metal vessel containing viscous fluid, C, and this is swung so far below, although attached to the bowl of the compass, that great steadiness is obtained even when the overweight of the compass is increased by the use of the Azimuth mirror.

It will be recognised by this improvement broken or cracked glass viscous fluid bowls (which cannot be obtained in foreign ports) are entirely obviated, the safety of the compass is secured, and great steadiness of the instrument in a seaway is obtained.

The Azimuth mirror has a shade over the pointer, D, hinged for adjustment to the light in such a manner that the reading on the card is greatly facilitated. This very simple improvement will, we are sure, be greatly appreciated by users when taking Azimuth bearings with the instrument. A very useful and convenient characteristic of this new instrument is the conical binnacle top provided with sighting lines on the glasses at each side, E, and cross-bearing sights and divided bezel at the top, F.

Double beads, G, are provided on the binnacle cylinder, over and above which the conical top works; these beads prevent water entering the binnacle, and are utilised as guides for the milled plunger fittings on either of the sides, H, which hold the top to its bowl. Heretofore the binnacle top has been held on to the cylinder or bowl by claws which are made to fasten on the top by cuttings in the wiring around the flange of the top, a mode of construction which greatly weakens the top, and we feel sure that this new method of fixing the top to the bowl of a binnacle will appeal to all users of the instrument as an important and useful improvement.

We would draw attention to the new registered design of compass card, illustrated on the lefthand side of Fig. 2, the degrees of which are of varying length in order to simplify the reading.

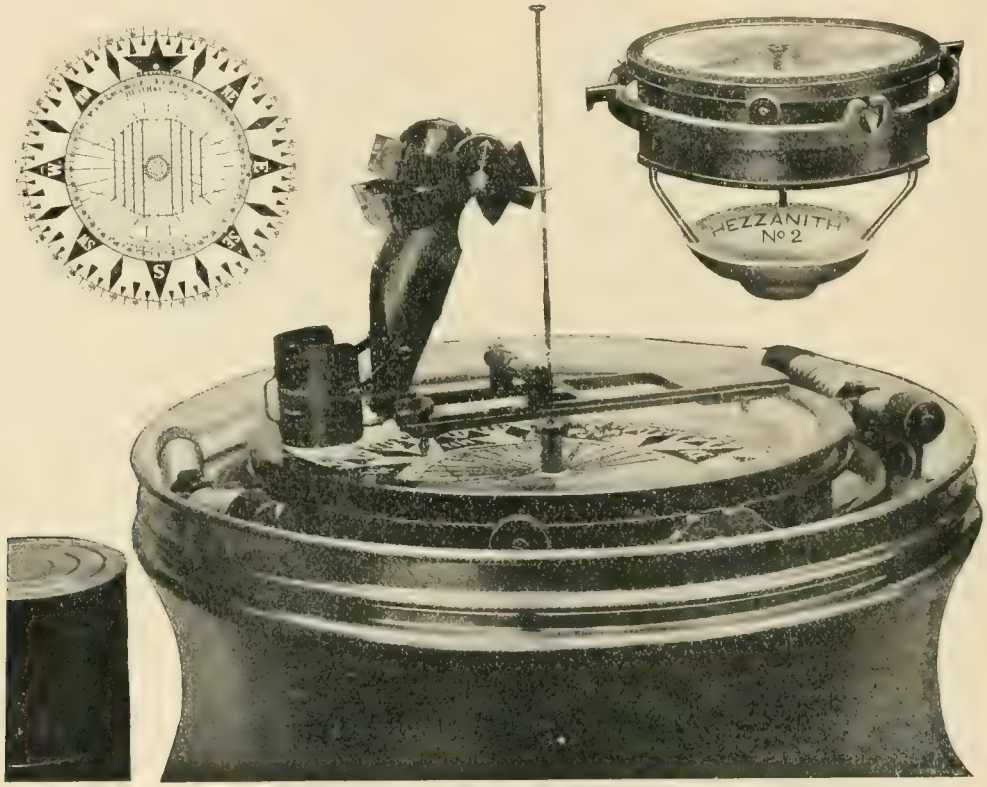


Fig. 2.—The New Hezzanith Standard Binnacle.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

As is well known, in recent years there has been a great increase in the application of electricity on board men-of-war. Amongst these, the rotating of turrets in this way is commonly done. A method employed for the purpose is to use two motors—one for quick movements, and the other for aiming. The former may be of 40 to 50 H.P., and run at a revolution of 800 per minute, corresponding to a speed of turret of 4 deg. per second. The smaller motor is arranged for a speed of 100 revolutions per minute, varying up to 200. The two motors are so combined that the aiming one is always used to start the turret, and is then cut out, and the large machine used, with the view of working several turrets at once, without excessive currents. The starting resistance on the large motor can be short-circuited by an electric relay across the motor armature, and as soon as the motor reaches its normal speed, and the counter E.M.F. its normal value, the relay cuts out the starting resistance. The electrically worked commutators reverse the motor, and short-circuit it, which gives a braking effect directly the main circuit is opened. The circuit of the small motor is similar in every way. The controller on the moving platform enables right and left aiming movements to be made, and the large and small motors to be operated at will. Steering-gear is another detail worked by this system. For this purpose, two rheostats are connected in parallel across the mains, and a sliding contact on each rheostat

connected to a relay, and, with the Wheatstone bridge thus formed, the rheostats form the four arms, the mains one diagonal and the relay the other. One sliding contact is then connected to the steering-wheel, and the other to the rudder. When the steering-wheel is moved, the bridge is put out of balance, and the relay worked, by which a secondary circuit is closed, working a commutator and automatic starter of the rudder motor. As the rudder turns, the sliding contact connected to it brings the bridge to a balance, and the relay opens the motor circuit, the motor being short-circuited as soon as it is cut off the mains, so as to bring it to rest as quickly as may be. This arrangement of steering is said to work perfectly in every way.

A form of electric crane of some interest contains two lifting magnets, suspended from the wire ropes of two hoisting-drums. The magnets are first lowered to the bars desired to be lifted, and then, being energised, hold the bars. The magnets are then lifted with the load, until safety clips from above come into operation, for the purpose of retaining the load, should the current by any means fail while the load is being carried to destination. Energising can take place to any degree for lifting a small number of bars or lowering them one by one, the capacity of the two magnets being given as 2,000 kg. as a maximum, and the working speeds per minute as 15 m. in lifting, 45 m. in traversing the crab, and 100 m. in travelling. The whole of the gear is worked by two levers only, the energy being supplied through a flexible cable to the magnet as well as the driving motor. The merit of such cranes is that no slings are required, and no hold, in the way of supporting pieces on the load.

Driving a planing machine electrically enables calculations to be more readily taken as regards losses during different positions of the stroke, and the efficiency generally; and, from tests recently published, it appears that in forward cutting out of a total of 9,000 watts supplied, about 1,500 were used to cut the metal, giving 16 per cent. of useful power, the rest being absorbed in motor, gearing, and friction. The total time taken for the circuit was about 9 sec., while actual cutting took place during 5 sec., the depth and length of cut being given respectively as 7 16th in. and 21 in. approximately on nickel steel. The machine tested was a 36 in. by 36 in. by 14 ft., the motor being of the shunt type, running at 650 revolutions per minute at 220 volts, the weight of table being a little over 10,000 lb.

The troubles of dynamos and motors are distributed in order generally as follows, first with the armatures and then with the commutators. The mechanical parts come next, followed by the field magnet and brush-gears. Armature faults are mostly due to the burning out of the coils, sometimes the entire armature going, or only a coil or two. Defective insulation is a cause of defects, as well as dust and grease. Breaks in the wire are also sometimes answerable. Commutators fail often for purely mechanical reasons. They may burst, for instance. Where surface fusion has occurred, it is generally due to sparking destroying the surface. The shaft may become bent, the armatures getting out of centre, due to wear in bearings, and an unbalanced magnetic force, added to the weight of armature, helps to produce a bending moment. The insulation between the segments of the commutators may be defective, owing to the substitution of inferior material for mica, and which would be likely to absorb moisture. We have enumerated only a few of the possibilities of failure. Others will occur to users.

Messrs. Edward Finch & Co., Ltd.—The payment of the usual dividend of 12½ per cent. was confirmed at the General Meeting, held on September 19th, carrying forward £3,770 10s. 1d. to next account.

Institute of Marine Engineers (Incorporated). The annual dinner in connection with this Institution will take place in the King's Hall, Holborn Restaurant, Holborn, W.C., on Wednesday, October 3rd, at 6.30 for 6.45 o'clock p.m. The Office Bearers and Council are desirous of giving a very hearty welcome to the President, and hope for the support of every member on this occasion. A reception will be held by the President, the Right Hon. Lord Pirrie, at 6.30, in the Ante-room.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

AT the time of writing no reply had been made public by the Clyde Shipbuilders' Association to the notification from the Boilermakers' Association that their members employed in Clyde shipyards would cease work on the 29th inst., unless the employers grant an advance of wages or submit the question of wages to arbitration. The strike will affect about 7,000 shipyard men, and if it continues, the boilershop-men, and also other classes of shipyard workers, will be thrown idle. The Clyde local committees are appointing strike committees, arranging for the distribution of strike pay, and for setting up all the organisation necessary for the carrying on of a prolonged strike, and also calling aggregate meetings of the men, in order to lay the position fully before them. The employers are emphatic in stating that the condition of trade does not warrant any advance of wages, as although a large tonnage has been launched recently the work actually under construction has been very much reduced, and great difficulty is being experienced in obtaining new contracts. The men voted by 4,748 votes against 1,267 in favour of striking for an advance of wages.

Mr. Robert L. Scott, of Messrs. Scott & Co., of Greenock, has been appointed a trustee in room of the late Mr. J. D. Clink, by the trustees of the Clyde Lighthouses

The new tide signalling apparatus (of which we gave full particulars in a recent issue), invented by Mr. Martin Boyd, harbour-master, Irvine, has been found to indicate with great accuracy to ships outside the depth of water on the bar at any state of the tide by day or night.

The Khedive of Egypt's steam yacht *Mahroussa*, which since February of last year has been in the hands of Messrs. A. & J. Inglis, Ltd., Pointhouse, was taken down the river on September 12th, for a final cruise prior to leaving for Constantinople. A mean speed of 17¼ knots was attained on four runs over the measured mile at Skelmorlie, the engines running at 456 revolutions and developing slightly over 5,000 I.H.P. The vessel has been most sumptuously fitted, and Messrs. Inglis are to be complimented upon having creditably accomplished a difficult task.

Clyde shipbuilding firms have built this year for South American owners an exceptionally large number of vessels, and at present Señor Nicholas Mihanovitch, Buenos Ayres, is having vessels built for him at three yards on the Clyde.

At the several shipbuilding districts on the Clyde some 166,000 tons of new vessels are being fitted out, ranging from the trawler of insignificant dimensions to the great Cunarder *Lusitania*, and it is safe to say that never previously has there been at one time so much new work launched and being prepared for sea.

THE TYNE.

(From our Own Correspondent.)

Shipbuilding.—The members, or the officials, of the Boilermakers' and Iron Shipbuilders' Society on the North-East Coast, appear to have adopted the notion that the present is a suitable time for putting forward a claim for an advance of wages—a time when freights are unremunerative, when many yards are beginning to show empty berths, and when new orders for cargo steamers are almost impossible to get. And let it not be forgotten that though warships and passenger vessels now and then make an acceptable addition to the volume of trade, the supplying of cargo boats is really the main source from which the prosperity of the shipbuilding industry is derived. No kind of demand is sufficient to keep shipbuilding busy, if the demand for cargo boats is lacking; good prices for tonnage cannot be

maintained unless the demand is brisk, and, in the absence of fairly remunerative prices, it is impossible to advance wages without permanent injury to the trade. At the moment, the world is over-supplied with cargo tonnage, and every day this evil—if it is one—is being added to. In such circumstances, the shipbuilding industry can hardly be said to be in a prosperous condition; and, as a matter of fact, many firms have already had to reduce quotations, in the vain effort to secure new orders. Under such conditions, it is palpably absurd to seek any enhancement of the wages rates; and one can only wonder at the want of sense displayed by the union leaders who would propose to do so. Regular employment is of far more importance to the men than the addition of a shilling or two to their weekly incomes; and it is only by the maintenance of peaceable relations that there is any chance of regular employment being maintained. Even with constant peace, slackness must come occasionally; but the men well know that any disturbance of friendly relations between themselves and their employers is bound to aggravate the evil, and has always done so. Why not then have a Conciliation Board established for the settlement of all disputes arising between the employers and the members of the "black squad," in the shipyards of the North-East Coast? It could easily be arranged, if anyone of influence among either the employers or the employed would take the initiative, and it would be an incalculable advantage to all concerned.

By the time these lines are in print, the great event will have happened—the event that must be regarded as unique in this district—namely, the launching of the express liner *Mauretania*. The subject will, no doubt, be dealt with elsewhere in this issue; but it may be stated in this column that no shipbuilding event, not even the launching of the first warship from the Elswick Yard, has excited such absorbing interest among the inhabitants of the great Tyneside centres. The building berth for this vessel was made specially for her, at a very great expense, being closely piled from end to end to ensure a stable foundation for the great structure, and being also completely covered, to admit of work being carried on in all weathers. It is to be hoped that it will not be long till this exceptional accommodation will again be utilised, and, though it is not to be expected that another such vessel as the *Mauretania* will be put down very soon; it is scarcely to be doubted that the firm will ere long secure an order from some of the other great shipping companies for a vessel fit to occupy this berth. It is, indeed, stated, on what appears to be good authority, that several of the larger companies are now in the market with enquiries for vessels to be fitted with turbine machinery, and it will be strange indeed if the enterprising Wallsend firm does not succeed in bringing to their yard some of these special contracts. The launch of the *Lord Nelson* battleship from the Jarrow yard, which took place on the 4th inst., was also an event of exceptional importance; and it is creditable to the company that the vessel was ready for putting into the water in little better than eighteen months from the placing of the keel. The electric hoisting gear over the berth was largely instrumental in realising this satisfactory result, and now that two other berths are similarly equipped, the company may be said to be in a position to compete successfully with all rivals, whether at home or abroad. Messrs. Hawthorn, Leslie & Co., Messrs. Stephenson, and the Northumberland Shipbuilding Company, are still maintaining every appearance of briskness; but at some of the other shipbuilding establishments signs of incipient slackness are noticeable. The Smith's Dock Company have a large amount of repair work in hand; and other repairing firms are also well supplied. The ss. *Weybridge*, which, some months ago, was badly damaged in the River Plate, has been brought to the Tyne for a general overhaul, temporary repairs having been carried out to enable her to make the voyage.

Engineering. Though night work is still very generally maintained in the marine engine works, signs that the pressure is lessening are not wanting, and we shall not be surprised to hear that at a certain number of the works the management will very shortly decide upon running the machinery during ordinary hours only. Messrs. Clark, Chapman & Co. are still very busy in the various departments of their extensive works; and at the Northern Machine Tool Works, Felling, orders for different specialities are being received in sufficient numbers to keep the works fully going.

The Parsons' Turbine Works, Walker Gate and Wallsend, continue to be exceedingly busy, several orders of importance having been booked lately. The demand for Messrs. Henry Watson & Son's engineering specialities, including their well-known ballast pumps, is well maintained, and their works are kept in full activity. The works of Messrs. Donkin & Co. are also well employed, the firm having a large number of orders for steering engines, both for home and foreign account. Messrs. J. H. Holmes & Co., electric light engineers, are very busy with ship installations, having contracts in progress at nearly all the principal shipping centres. Messrs. Scott & Mountain, Ltd., Gateshead, are very busy with electric installations for collieries, and since their removal from the Close, Newcastle, to the much larger works which they now occupy, have attained to a productive capacity considerably in excess of what they were able to do in former years.

THE WEAR.

(*From our Own Correspondent.*)

Shipbuilding.—Messrs. Doxford are reported to have booked an order for a turret steamer within the past few days; but it has not transpired that any other firm of builders has secured additional work. An important launch has taken place at the yard of Sir James Laing & Sons, and we understand that the construction of another steamer will be immediately commenced in the vacated berth. At this yard a further step has been taken in the direction of economical working. By an arrangement of templates, the rivet holes are now marked on the shell plates before the latter come into the platers' hands, thereby saving both time and labour; and, though there was apparently some little grumbling at first on the part of the operatives, the new plan now seems to be accepted without question. Messrs. Pickersgill have commenced the extensions to their yard; and at Messrs. Priestman's establishment preparations are being made for launching a large cargo boat ordered by Greek owners. The firm are also preparing a berth for the laying down of a twin-screw passenger steamer of over 400 ft. in length, ordered by owners of the same nationality. Taking into account the other work in hand, this firm are pretty certain to be kept busy well into next year. Messrs. Osborne, Graham & Co. have three boats on the stocks; and at Messrs. Short Brothers four vessels are in progress, one or two of them being of very large size.

Messrs. J. L. Thompson & Sons are about to put another vessel into the water, and this, we believe, will make eight launched this year. The frame-building and designing departments, being still pretty busy, it may be presumed that when the vessels now in hand are completed, there will be others to replace them.

Messrs. S. P. Austin & Sons still appear to have a good supply of new work, and quite recently put down a keel in a berth from which a launch had taken place. The firm have just completed a rather complicated repair to a Danish cargo steamer, which had been damaged by colliding with the pier at a French port. The firm have another vessel under repair in the graving dock, and two in the river being fitted out. Messrs. Bartram, South Dock, have two large vessels in hand; but at the Sunderland Shipbuilding Company's yard the pressure of work does not appear to be so great as it was earlier in the year. Messrs. Blumer have three boats in hand; and at Messrs. Crown's yard the new work department is fairly busy. The latter firm is also well supplied with work in the repairing department.

Engineering.—The North Eastern Marine Engineering Company continue busy at both their Sunderland and Wallsend works; and Messrs. Dickinson also keep very fully employed. Messrs. George Clark, Ltd., have received the contract to supply the duplicate engines for a large passenger steamer, ordered from Messrs. Priestman by foreign owners. Messrs. Doxford's engineering department is taxed to its fullest capacity to meet current requirements; and at Messrs. Richardsons, Westgarth & Co.'s works all the departments are kept going briskly. No perceptible falling off is to be noted at Messrs. John Lynn & Co.'s works, in which ships' steering engines constitute a very large proportion of the output; and at the Sunderland Forge and Engineering Company's works a satisfactory degree of activity is still maintained. Other works engaged in the manufacture of steamship auxiliary machinery are not quite so busy as they were some months ago.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

THE approximate traffic returns just published by the Manchester Ship Canal Company foretell a big increase in revenue for 1906. For August, the revenue amounted to £43,710, against £38,574 last year, and for the eight months £315,693, as compared with £281,205 for the corresponding period in 1905. This is an increase of £34,488, already more than £3,000 ahead of last year's increase. During the last ten years the record increase is £51,026, which was established at the end of 1902. The last months of the year are invariably the best, and there is hope of a better record. The continued improvement in trade has had a beneficial effect on Ship Canal traffic. With regard to timber traffic, Manchester has been found to be a good centre for "dumping" purposes. The shipments this year have been heavier than ever. There have been times when the company's storage has been heavily taxed. Last year's record will be easily broken. Another favourable feature has been the heavy outward traffic. The coastwise shipments, as well as foreign trade, have been progressing. The coaling basins of the company at Partington are becoming better known and more frequently used. Coal traffic has increased. During the last fortnight over a dozen vessels laden with coal have sailed for various ports in Ireland Isle of Man, the South Coast, and elsewhere. One vessel left for Alexandria.

There has been some talk here of the reversible turbine the patent rights of which had been purchased by the North German Lloyd Steamship Company, but it is said there is no real novelty about the idea. Reversible turbines and gas turbines are offered almost every week to the marine engineers on the Tyne and the Clyde. These inventions, it is said, should make some reputation on land before being put on ships.

During the month a rather serious fire broke out in the warehouse of the Liverpool Warehousing Company, Ltd. at Trafford Docks, standing on the brink of the canal. The warehouse is divided into three sections, A, B, and C, which are separated from each other by party walls. The fire broke out in the fourth floor of section B, which, together with the two floors above it, was stocked with cotton. It was ten o'clock in the morning when the outbreak was discovered. Several fire brigades were soon at work. In a few minutes half-a-dozen jets were playing upon the burning section. The fireboat *Fire fly*, and two steamers from the Manchester Fire Brigade further strengthened the attack upon the flaming cotton. By noon, however, the fire had reached the roof, which, with the hoist, fell with a terrible crash. It was four o'clock before the firemen ceased their efforts. The three floors and the cotton with which they were stored were destroyed. The damage was very serious.

A clever engineering feat was accomplished on the 8th inst. in the Ince section of the Ship Canal opposite Frodsham, viz., the laying of a huge syphon on the bed of the Canal to convey the sewage of Frodsham and the stream Hoolpool Gutter into the River Mersey. The syphon was constructed of 6 ft. iron pipes, with a diameter of 3 ft. 6 in. Two lengths of pipes were strongly bound together, and then covered with a coating of cement 5 in. thick, held together by steel wire netting. When completed, the syphon was 180 ft. long, and weighed 240 tons. One hundred and fifty men were employed. The syphon was dropped into the waters of the Canal under the personal superintendence of Mr. Hunter, the chief engineer to the Ship Canal Company.

Five foreign ship's firemen, employed on the ss. *Inchdune*, were charged, before the Salford Stipendiary, a few days ago, with disobedience on the high seas on August 29th. The vessel was on a voyage from Zanzibar to Kurrachee. A pump wanted repairing, and the defendants were asked to do the work, but refused, and the repairs had to be done by greasers and unskilled men. The defendants were each sent to prison for fourteen days.

An important discovery has been made on the Holford Hall estate, Cheshire, which is likely ere long to bring additional business to the Ship Canal. Brine measures have been reached at a depth of 75 ft., with 193 ft. of salt rock. The estate is 160 acres in extent.

The timber season at the Ship Canal Docks has so far proved exceptionally good, so much so that the prospects point to a record. Timber has come from nearly all the best known exporting centres. Of the total imports last month from New Brunswick and Nova Scotia, spruce and pine deals, no less a proportion than 82½ per cent. came here. The bulk of Canadian wavy pine exported was also brought to this port.

Messrs. Lamport & Holt, shippers, of this city, state that out of their total imports of cattle from New York to Manchester Docks, their loss only amounted to .04 per cent., which is equivalent to 1 in 2,500.

The well-known Isle of Man steamer *Ben my Chree* has been sold by the company to a Preston firm. She is to be broken up.

Great complaints have been made by residents in the locality at the practice of the Ship Canal Company in burning refuse near their coal tips at Cadishead and Partington. It is recommended that a proper destructor be erected.

The Lancashire coal trade continues steady. The demand for house coal is improving. In all kinds of fuel for engines and furnaces there is an unabated inquiry. Prices have not varied from our last published list, but slight increases are being secured on next year's contracts. More gas coal and cannel are being sent out on existing contracts. The operative miners are moving in the direction of higher wages. Meetings have been held during the last few weeks with a view of securing a better constitution of the Coal Conciliation Board. The men say the preponderating influence in its constitution is on the side of the masters. They would like the Board to meet quarterly, and even fix the prices of coal contracts.

The iron trade of the county may be said to be in a state of more than ordinary prosperity. Prices are higher than at the beginning of September. Copper, tin and lead also keep very dear. Textile machinery works are exceptionally busy both for the home and export trade. Electrical machinery is being gradually absorbed in the new cotton mills, the boom in connection with which is not yet exhausted. The three latest spinning concerns are to be erected at Chadderton, Middleton Junction, and at Bolton. Millions of spindles are being put into new mills in various parts of the county and on its borders. Fear is expressed that there will be a slump in the cotton trade before long, so widespread is the new mill fever.

THE THAMES.

(From our Own Correspondent.)

ECHOES of the recent dock war on the Thames have been heard recently at the meeting of the Surrey Commercial Company. It appears it was the diversion of the Furness, Withy Line to these docks that caused the trouble, and in the terms of settlement—whatever these are the line is to be permanently transferred, we understand, and it will mean a very considerable accession of business to the Southern company, as fifty or sixty of these steamers are expected to use the dock during the course of a year, aggregating, approximately, 100,000 tons. Besides this line, there are the Allan and the Thomson Companies, who will continue on the Southern side by the terms of settlement, the Northern company receiving, no doubt, the wood trade that the Surrey company surrenders. The above three companies are all engaged in the grain and the provision trades; and, in view of the accommodation to be provided for them, the Surrey company have had to issue £150,000 5 per cent. Preference Stock, which was placed on the market at very satisfactory terms. We believe the terms of settlement are that neither company will in future endeavour to attract business from the other. According to the report of the Surrey company, there was a falling off of nearly 45,000 tons of wood-laden vessels in the year, and the war, therefore, was to make up this deficiency, attributable to depression in London trade generally. From the point of view of the dock company themselves, the settlement is a satisfactory one.

The London local marine board has joined in the protest raised against the recent Board of Trade circular, authorising a trades union delegate to be present in dis

putes between master and crew. This is said to be against the rules of the Merchant Shipping Acts, which make the superintendent the arbitrator in case of disputes. The London board protests, and urges that the Board of Trade has exceeded its powers, and asks it to withdraw the circular.

The South-Eastern Railway Company have placed orders for two more turbine steamers, to be delivered by Messrs. Denny Brothers & Co. in 1907. These vessels will be similar to the *Invicta*, which points to the fact that, for cross Channel service, the new type has been a success. A speed of 22 knots can be maintained, and the principal dimensions are: 324 ft. long, by 42 ft. broad, on a draught of 10 ft.; gross tonnage, 1,670; and 9,000 H.P. The General Steam Navigation Company have recently put into service the ss. *Woodcock*, a vessel built for them by Messrs. Gourlay Brothers & Co., of Dundee. The vessel is of the shelter-deck type, 270 ft. long by 39 ft. wide and 24 ft. deep, and gross tonnage of 1,650. Accommodation is provided for 44 first-class passengers and 12 second-class passengers, nearly 16 knots being attained on the trial trip. The vessel is up to date in every way. One of this company's vessels, the ss. *Balgownie*, was on fire recently at Cotton's Wharf, in Tooley-street. The fire originated in No. 2 hold, and it was only prevented from spreading after the contents of No. 1 hold were practically destroyed and considerable injury done to that portion of the boat.

The large steam packet companies, both British and foreign, have for many years had West End offices, and attention is drawn to their requirements in this direction by the acquirement of a large block of premises in Cockspur-street, facing the Haymarket, for the use of the Hamburg-America Company. On the site of the office now occupied by the company, and on property immediately adjoining, spacious offices will be erected for the purposes of the large business concerned, which is known, from the point of tonnage, to be the largest in the world.

The order of the day is still discharges from Woolwich Arsenal, and the latest department to be affected in this establishment is the torpedo factory, which has hitherto always had a steady flow of work in it. Workers in the East End are becoming alarmed at the state of matters, as it tends to swell the general numbers of the unemployed. Meetings have taken place at Bow as regards the congestion of the labour market, which will result from these discharges; but, with the cessation of the late war, it would seem that reductions were certain to follow. The question shows how difficult it is for a public body of any kind to engage direct labour, as a position like the present one is bound to come sooner or later. The inevitable dispute occurs, the employer and the employed not taking the same view, and labour demands from the public purse what it would not expect from the private individual.

In the motor-boat races which recently took place at Burnham, in the Thames estuary, the Yarrow-Napier boat, owned by Mr. Lionel de Rothschild, was victorious over *Napier III.*, of Mr. S. F. Edge, the average speed attained by the leader being 22·9 knots. The winning boat is only 40 ft. long, so the performance is a remarkable one for so small a craft.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—There is no material change to note in the condition of the shipbuilding trade of this district. No new orders have been reported during the month; but there are indications which make one believe that, at any rate, Vickers, Sons & Maxim "have something up their sleeve," as they are proceeding as briskly as ever with the work of enlarging their yard and fitting it up with all the most up-to-date appliances to ensure rapid and economical work. The firm has, indeed, employed a wealth of enterprise in developing the Naval Construction Works at Barrow; and before very long they will be able to deal with a great volume of work at one time. The Naval Construction Yard is large enough to enable some twenty to thirty vessels on the stocks at one time, and even half of those the largest vessels ever built. The firm, however, have had before them the policy of warship construction as the means of employing the Barrow yard, and they have been refusing for some time past ordinary merchant work. They would likely take orders for the latter if there was not a demand at the moment for warships. Orders for the latter are, however, somewhat slow in coming out; and one of the reasons for this is the fact that recent naval engagements have necessitated changes in plans and designs, to make the modern warship equal to the new conditions which now exist. The movements of the several Powers in the matter of new design are being watched carefully; and the general tendency, so far as it can be seen, is to build very large and powerful battleship cruisers which are a cross between the old-type battleship and fast cruisers, and vessels of the scout class, known as "the eyes of the fleet." It is probable orders for some of these vessels will soon be placed at Barrow. Russia is in the market for a big fleet, and it is understood some good orders from this source are likely to come to hand soon; but here, again, the difficulties as to design and the changes which are constantly being made, coupled with the unrest which continues to exist in Russia, have prevented the placing of business which has been in contemplation for some time. It is known that Sir William Armstrong, Whitworth & Co. took the option, when they secured the contract for three Brazilian battleships, to place the order for one of them with Vickers, Sons & Maxim; but the definite arrangements for this transference of work have not yet been completed. Work from other sources, however, is likely to come to hand at Barrow. The Vickers firm had the chance of building two of the new Australian mail steamers, but transferred the order to Wm. Beardmore & Co., in which they have the half interest, and this firm will build four of these ships.

During the month the second cruiser built at Barrow for the Peruvian Government, the *Coronel Bolognesi*, has been launched. She is described on another page. Her sister ship, the *Almirante Grau*, is taking her trial trip. She is designed to steam at a 24-knot speed, and looks as though she will be readily able to do that.

A sad and fatal accident occurred early in September on the Russian cruiser *Rurik*, building at Barrow, by which four lives were lost and many men were injured. An explosion took place in one of the auxiliary engine-rooms, in the fore part of the hold of the cruiser. It is not known what was the cause of this; but it was stated at the inquest that fumes of gas were collected in this room, and that the explosion was caused by taking a naked naphtha lamp into the apartment. Whether this was the cause of the explosion or not will never be known, as those who survived the accident have no knowledge of how the accident happened at all. At any rate, the explosion was a terrific one, but it did not do any material damage to the ship; and the date of her launch—probably some time in October—will not thereby be delayed. There was some fear that the explosion was caused by a bomb, but there is reason to believe that it was a pure accident. The firm are behaving in a very praiseworthy manner with the relatives of those who have lost their lives, and also with those who were injured. The firm paid the cost of the funerals, which were very affecting, and the town displayed the greatest sympathy with the bereaved. One of the new submarines, *C1*, built at Barrow for the British Navy, is now completed, and ready to be handed over to the Admiralty. She has much fuller power than the "B" class, which, in its turn, was an improvement on the "A" class, and she is propelled much more quickly both on the surface and when submerged. This extra speed has been accomplished by the adoption of the twin-screw. The still newer class of submarines, which will be known as the "D" class, mark a further improvement both in size and speed. It is understood most of these vessels will be built at Barrow, but some of them are to be built in the dockyards.

West Cumberland.—A steady trade in shipbuilding is being done at Workington and Maryport, where vessels of small tonnage are mostly built, and where there is almost a regular succession of orders. The need of a big engineering firm in the district is very much felt at the moment, as all vessels built in West Cumberland have to be towed to the Clyde to receive their engines, and it is felt, if orders could be completed on the West Cumberland coast, there would be a fuller business done and more men employed and more profit for those who have invested their capital in this industry.

Shipping Material.—The report is to hand of a rather fuller demand for shipbuilding material, but local mills have not been regularly employed of late, and unless new orders come to hand from local sources, it is probable that short time will have to be worked. Ship plates are at £7 7s. 6d. per ton net cash. Steel foundries are quiet.

Hematites.—The hematite iron trade is brisk, and prices show an advance, warrant iron being at 67s. 4½d. net cash sellers, buyers 67s. 3d. Stocks are lower at 68,500 tons.

Shipping.—A quieter tone is reported in the shipping trade at West Coast ports. The aggregate shipments this year have reached 579,202 tons, a decrease on the corresponding period of last year of 8,491 tons.

BELFAST.

(From our Own Correspondent.)

SEVERAL fresh orders have been booked in Belfast since last month's "Notes" were published, and a continuance of the present activity in the local shipbuilding trade may be looked for. In addition to these new contracts, it is expected that the Belfast yards will benefit by the extensive building programmes that the Hamburg-American and Holland-American Companies have before them. During the nine months of 1906 that have elapsed, over 105,000 tons have been put in the water from the Lagan yards, and, with several large vessels still to launch before the close of the year, Messrs. Harland & Wolff, and Workman, Clark & Co. will doubtless take high positions in the output lists for 1906.

Messrs. Harland & Wolff have launched two steamers during the month—the *Rohilla*, for the British India Steam Navigation Company, and the leviathan liner *Adriatic*, for the White Star Line. The former vessel, which was sent from the stocks on the 6th, has a length of 460 ft.; breadth, 56 ft.; and 7,000 gross tonnage. She will have superior accommodation for a large number of passengers, most of the staterooms being arranged on the tandem system. The *Adriatic* was launched on the 20th, the same day upon which Messrs. Swan & Hunter launched the *Mauretania*, the second of the two big boats building for the Cunard Company, the White Star Line's Atlantic rival. The *Adriatic* went off without a hitch exactly at the time arranged—11.15 a.m. It is a noticeable feature of Messrs. Harland & Wolff's launches that they always do take place to the minute. It has, in fact, become a saying that "you can set your watch by a Queen's Island launch." The latest addition to the White Star Line is a vessel of 25,000 gross tonnage, and, though in Belfast the sending from the stocks of leviathans is by no means an uncommon event, the ceremony was witnessed by a crowd of anything up to 50,000 people. Full particulars of the vessel appear elsewhere. On September 15th, the new Hamburg American liner *Salamanca*, which is intended for the company's South American trade, had a successful trial in the Lough, after being completed at the Queen's Island. The new vessel is 400 ft. long, by 50 ft. broad, by 32 ft. 2 in. deep, with a gross tonnage of about 6,000 tons.

Since last month's issue, Messrs. Workman, Clark & Co. have secured the order for two more of the Lloyd-Brazileiro steamers, making four altogether to be built by them for this company. These orders, in addition to others, and to the work at present in hand, will keep the firm's two yards busy for some considerable time to come. September 18th may be looked upon as a red-letter day in the progress of shipbuilding, so far as Messrs. Workman, Clark & Co. are concerned. On that day the *Araguaya*, the latest addition to the fleet of the Royal Mail Steam Packet Company, underwent a most satisfactory trial in Belfast Lough, and the vessel is undoubtedly the finest yet built by this firm. The dimensions of the *Araguaya* are: Length (between perpendiculars), 515 ft.; moulded breadth, 61 ft.; moulded depth, 34 ft.; and gross tonnage, over 10,500 tons. It is not necessary to give in these "Notes" a detailed description of the vessel, and the passenger accommodation may be briefly characterised as luxurious in the highest degree.

Some time since, the Canadian Pacific Railway Company decided to make Belfast a port of call once a fortnight for their intermediate boats. The vessels will lie at the entrance to the Lough, and passengers will be taken down from Belfast by tender. On September 13th, the first call was made by the *Lake Erie*. A number of Irish passengers took advantage of the improved facilities, and some 30 odd tons of cargo were shipped.

Recently, the Belfast Harbour Commissioners, accompanied by Mr. Redfern Kelly, the Board's engineer, made an inspection of the work being carried on in connection with the repairing of the Alexandra Graving Dock. A brief description of these operations may be interesting. With a view to effectually preventing any further subsidences, the damaged outer end of the dock has been cut off by a cofferdam across the entrance, and a row of sheet-piling parallel with each of the side walls, the grooves between these piles being filled with concrete, forced in by hydraulic pressure. Across the dock at the inner end of the damaged portion a steel caisson is being erected, the lower section of which will form a chamber 125 ft. long, by about 6 ft. high, in which a number of men can work, under compressed air, for the purpose of making a cutting in the floor of the dock, through which the caisson will be sunk until it reaches 3 ft. into the boulder clay below. The undamaged length of the dock will thus be completely isolated and safeguarded against any chance of undermining, whilst the repairs are being executed. The work is well advanced; the steel caisson is being riveted up in position, and the air-compressing machinery erected.

JUNIOR ENGINEERS.

By W. W. A.

AS stated in our August issue, we intend opening a page for junior readers, more especially apprentices, in connection with whose daily occupation there are many points one would wish to see explained and discussed; and we invite queries and replies on all subjects having a direct bearing on the design, construction, and care of marine engines and boilers. There are also things done in some shops which yet pay their way, having regard to limited space and capital, old methods which have survived the tidal wave of progress, machines of days gone by; this is particularly the case on board ship, and many curious devices are adopted, which to the modern machinist are crude in the extreme. The ancient treadle-lathe of some tramp steamers has much to answer for in the way of turning, slotting, and planing, which the apprentice of the present day training knows nothing of; these are the things which make for resourcefulness in the seagoing engineer—the ability to cope with things under the most adverse conditions, and to utilise to the best advantage the barest supply of material.

A series of articles will be commenced dealing with modern practice in the various stages in the manufacture of the propelling machinery, embodying descriptions of new machines, illustrated, where possible, by means of sketches and photographs. These articles will of necessity be of a more or less elementary practical nature, to appeal to those who are just starting upon their term of apprenticeship, and to give to such some idea of the work carried on in the several departments.

Pattern-making.

Wood-working machinery has become so necessary to the rapid production of patterns, that it naturally falls into place as one of the prime factors of shop arrangement, the more general types in use comprising circular, jig, and band-saws, planers, trimmers, lathes, and emery grinders.

For all except the largest shops, one of each saw is sufficient.

Of planers, one will be required for surface planing, and one for facing; it is not advisable to make one machine serve both purposes, as the speed of the latter should be considerably the greater, and even where a two-speed pulley is fitted, the machine may have more work than it can overtake, with consequent loss of time. The surface planer will have a thickness gauge, the "facing-edger" a bevel gauge, which should be capable of being rapidly as well as accurately set.

The trimmers, of which there may be one to every six of eight men employed, have adjustable gauges for bevels.

Two or three lathes will suffice for the general run of work, the largest being capable of taking up to perhaps an air-pump barrel or a piston-valve; any work larger than this

that requires to be done in the lathe can quite well be turned upon one of those in the machine shop, the expense of that particular job being balanced by the extra cost of a larger tool where capital and space may be limited.

The emery grinder for general work will have one broad wheel for the chisels, planes, &c., and three or four narrower ones for gouges, also a fixture at the end for the machine blades, unless the number of these warrants the installation of a special grinder for this purpose. Another will be required for saw-sharpening, with automatic tooth-setting device, and although the usual practice is to file-sharpen, grinders for this purpose are coming very largely into use.

There may be a separate machine for half checking boards in making heavy framework and templets, or this may be an attachment on the planer or one of the circular saw arbors, where the machine is equipped with two, the blades being adjustable as regards breadth and depth of cut.

There should also be attachments for making lengths of fillet, beading, rounded edges, grooves, and dadoes, or these may be all driven off one of the lathes, and fixed on the end of the bed.

Electric and pneumatic tools have not been adopted to any large extent, as the light nature of the work is not favourable to their use; where, however, there are a large number of holes to be bored or screws to be put in, the saving is more than problematical, as in the screwing up of a previous set of cylinders, columns, and bedplate, where the work is compact and of a similar nature throughout.

The usual drive is electric, with one motor for the entire line of shafting, the machinery being all in use, running at constant speed, and, being continually put on and off, the wear and tear on shifting belts will be less than that on motor switches.

The illustration shows the Colburn saw table, for which Messrs. Ludw. Loewe & Co., Ltd., of London, are sole agents, and which is specially adapted for patterns.

This machine has two arbors, and will cut 4 in. deep with 14 in. saws, or with one 18-in. saw will cut 6 in. deep, at 2,800 R.P.M., with 5-in. single belt on a pulley 4 in. diameter; it occupies 42 in. square floor space.

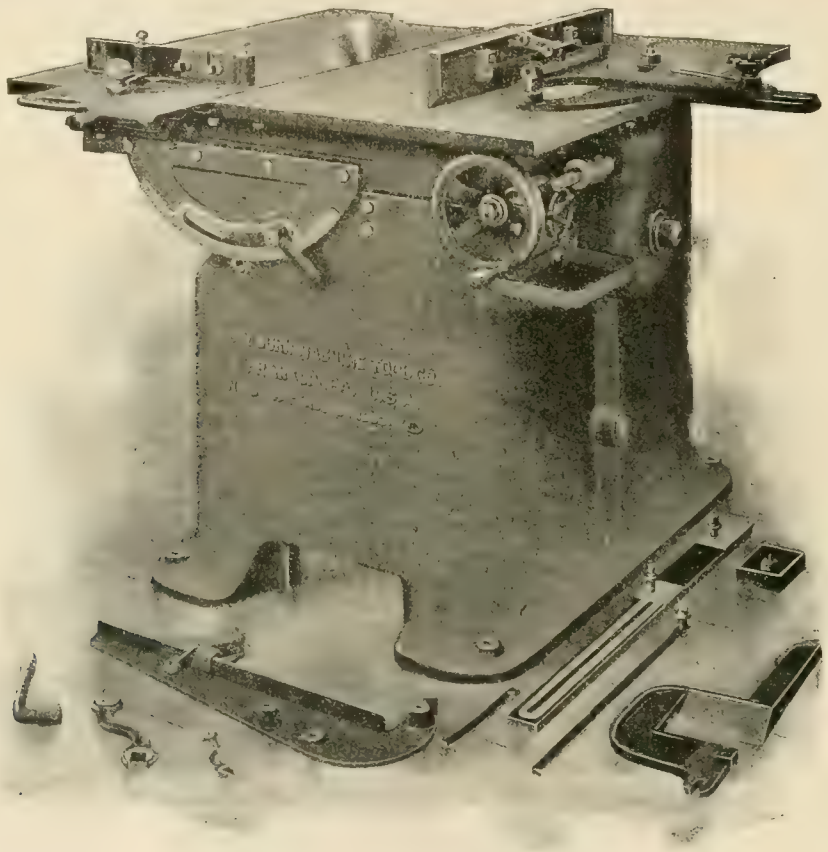
The table tilts to 45 deg., the angle being governed by the graduated arc on the left; the large hand wheel to the right actuates a worm-gear for raising and lowering the saws.

The left side of the table can be moved out to allow of grooving or dado heads up to 2 in. diameter being used.

The fittings shown in the cut enable a large variety of work to be done which formerly was rough-cut and finished by hand, polyhedral frames, cylinder staves, bevelled patches, and similar work, which can be finished off with a smooth plane.

The middle portion of the table is movable, and slides parallel to the face of the saw. This slide carries a cutting-off gauge, which is swung on a graduated arc, and is held to the table by means of two taper-pins, and drilled for several angles, intermediate angles being obtained by means of the clamping screw.

The machine, as a whole, is of substantial design, and is representative of the best of its kind.



The New Colburn Universal Saw-Table.

Tourcoing Exhibition.—The jurors of this exhibition have awarded a gold medal to the exhibit of the United States Metallic Packing.

Electrical Exhibition. — An exhibition of electrical machinery and appliances is taking place at the Corn Exchange, Sheffield. The display was opened by the Lord Mayor of Sheffield at 3 p.m., on September 27th, and will remain open to the public daily, from noon to 10 p.m., until October 20th. A number of exhibits of peculiar interest to the local metallurgical and engineering industries have been secured, as well as an elaborate display of domestic and public lighting apparatus, which will appeal to architects, decorators, furnishers, and householders.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Orland. Messrs. W. Harkess & Son, Ltd., have launched from their shipyard at Middlesbrough a steel screw steamer, 265 ft. by 36 ft. 8 in. by 20 ft. 4 in. (moulded). She is a single-deck vessel, intended for the China coast and general trades, and is intended to carry a cargo of 2,400 tons on light draught, and is built to the order of Mr. H. Fredriksen, of Sandefjord, Norway. On leaving the ways she was christened *Orland* by Mrs. Gerrard, wife of the owners' superintendent.

Rodney. On August 22nd there was launched at Beverley, for Mr. W. Grant, of Grimsby, a steel ketch-rigged steamer of about 250 tons gross, named *Rodney*.

Braconheath.—On August 22nd there was launched at South Shields, by Messrs. Jos. T. Eltringham & Co., a new steel trawler for the Don Fishing Company, Ltd., Aberdeen. The vessel is 115 ft. by 21 ft. 6 in. by 12 ft. 6 in., and has a large boiler, also constructed by Messrs. Eltringham. The vessel will have triple-expansion engines, and is to be fitted with all the latest appliances for efficient and economical working. The vessel was named the *Braconheath* by Mrs. Arthur Fitzgerald.

Primrose. On August 22nd there was launched at Appledore, by Messrs. Robert Cock & Sons, a steel screw tug, named *Primrose*, for the Sharpness New Docks and Gloucester and Birmingham Navigation Company. The tug is of the following dimensions:—Length, 68 ft.; breadth, 15 ft. 9 in.; and depth (moulded), 8 ft. 11in. She will be fitted with engines of about 220 I.H.P.

British Empire.—On August 23rd there was launched at Beverley, for the Cargill Steam Trawling Company, Ltd., of Hull, a steel ketch rigged steamer of about 290 tons gross, named *British Empire*.

Winfern. On September 1st there was launched on the Wear, for Mr. Andrew Eaton, a finely modelled yacht, having both sailing and motor power. Her dimensions are: Length overall, 33 ft.; breadth, 7 ft. 9 in.; depth, 4ft. 6in; with 12 ft. cabin.

Firefly. On September 1st the coastal torpedo boat destroyer *Firefly* was successfully launched from the works of Messrs. J. Samuel White & Co., Ltd., East Cowes. She is a sister vessel to H.M. ships *Cricket* and *Dragonfly*, launched by Messrs White a few months ago, and is the third vessel of her class to take the water of the five coastal destroyers building by this firm for the Government, under the 1905-6 naval programme. The vessel is 175 ft. long, 250 tons displacement on trial, I.H.P. 3,600, speed, 26 knots. Machinery watertube boilers, "White Forster" patent, fired with oil fuel, and turbines manufactured by Messrs. White, under Parsons' patent.

Harley.—On September 3rd Messrs Furniss, Withy & Co., Ltd., of Hartlepool, launched the large steamer which they have built to the order of Messrs. J. & C. Harrison, Ltd., London. Her total length exceeds 372 ft., classed 100 A1 at Lloyd's, has large measurement capacity, with clear holds and large hatchways. Shifting boards will be fitted throughout, and she will have seven large steam winches, donkey boiler to German Law and Hamburg Police requirements, steam and hand-steering gear, direct steam patent windlass, cellular double bottom fore and aft, with after peak available for water ballast. Accommodation is arranged on the bridge deck for the captain and officers, and the crew will be berthed in the forecastle. Engines of the triple-expansion type, by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, will be fitted, having cylinders 24 in., 39 in., 56 in. by 48 in. stroke, with two single ended boilers 16 ft. 3 in. by 10 ft. 9 in. long, 180 lb. working pressure. The vessel was gracefully christened by Mrs. R. T. Tidswell, of London, who gave the vessel the name of *Harley*.

Marstonmoor.—On September 3rd there was launched from the shipbuilding yard of Messrs. John Blumer & Co., Sunderland, the screw steamer *Marstonmoor*, for the Moor Line, Limited, of Messrs. Walter Runciman & Co., of Newcastle and London. The vessel is an exact duplicate of the last three steamers recently constructed by the builders for the Moor Line, of the single deck type, with perfectly clear holds, suitable for general trades, and particularly for carrying pitch-pine timber. Mr. Walter Runciman, M.P., Secretary of the Local Government Board, was present with Mrs. Runciman, who named the steamer *Marstonmoor*.

Millpool.—On September 3rd, Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions:—Length, 370 ft.; breadth, 51 ft.; depth, 28 ft. 5 in.. The vessel is classed 100 A1 at Lloyd's, and has been built to the order of the Pool Shipping Company, of West Hartlepool (R. Ropner & Co., managers), and is fitted with the builders' patent improved trunk deck, having wide-spaced hold beams, in addition to the complete trunk deck and is fitted with topgallant forecastle on trunk deck. The saloon house, with accommodation for captain and officers, and a house for engineers, will be fitted up on trunk deck, with the crew in the topgallant forecastle. The vessel has double bottom for water ballast on the cellular principle, also in the fore and after peak tanks. The deadweight carrying capacity will be about 7,000 tons, on Lloyd's summer freeboard. The vessel will be fully equipped with an up-to-date outfit, having a quick warping windlass, stockless anchors, steam-steering gear amidships, with powerful screw gear aft. The appliances for loading and discharging expeditiously are very complete, and include extra derrick posts and double derricks, nine steam winches, steam being supplied by a horizontal multitubular donkey boiler. The engines will be of the triple-expansion type, supplied by Messrs. Blair & Co., Ltd., of about 2,100 I.H.P., steam being supplied by two extra large main boilers, at a working pressure of 160 lb. per square inch. The christening ceremony was gracefully performed by Miss Margaret Ropner, "Ragworth," Norton on Tees, who gave the vessel the name of *Millpool*.

Skogland.—On September 3rd Messrs. William Gray & Co., Ltd., launched at West Hartlepool the handsome steel screw steamer *Skogland*, which they have built for Messrs. C. A. Forslind & Son, West Hartlepool. She will take the highest class in Lloyd's, and is of the following dimensions.—Length overall 342 ft.; breadth, 46 ft.; and depth, 24 ft. 4 in., with long bridge, poop, and topgallant forecastle. The saloon, staterooms, captain's, officers', and engineers' rooms, &c., will be fitted up in houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom, and large aft peak tank for water ballast, six steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, patent vertical multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts, with fore and aft rig, boats on beams overhead, and all requirements for a first class cargo steamer. Triple expansion engines are being supplied by the Central Marine EngineWorks of the builders, having cylinders 25 in., 40 in., and 65 in. diameter, with a piston stroke of 42 in. and two large steel boilers for a working pressure of 180 lb. per square inch. The ship and machinery have been built under the superintendence of Mr. R. Adams, on behalf of the owners', and the ceremony of naming the steamer *Skogland* was gracefully performed by Mrs. Albert Forslind, West Hartlepool.

Lord Nunburnholme. On September 4th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 130 ft. by 22 ft. 3 in. by 12 ft., depth of hold. The vessel has been built to the order of Messrs. The Yorkshire Steam Fishing Company, Limited, of Hull, and will be fitted with powerful triple-expansion engines, by Messrs. Amos & Smith, of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened *Lord Nunburnholme* by Miss Dorothy McCann, of Hull, after which the company adjourned to the builders' offices, where cake and wine was served, and the customary toasts given and responded to.

Fairport.—On September 5th Messrs. W. Doxford & Sons, Ltd., Sunderland, launched the turret steamer *Fairport*, for John Coull, Esq., of Newcastle. In general proportions the vessel resembles many recently built by this firm, the length being 366 ft.; breadth, 50 ft.; depth (moulded), 26¼ ft.; 6,600 tons deadweight are carried on a draught of 21 ft. 9 in. The vessel is of the new clear hold type, and embodies the latest improvements in turret construction. The cargo is distributed into the four clear holds into which the vessel is subdivided, by means of ten derricks which serve the five large hatchways giving access to these holds. The deck is furnished with seven powerful winches for working the cargo gear. The Bureau Veritas Registry has assigned to the

Fairport the highest classification. Engines and boilers are being supplied by Messrs. Doxford to give the vessel a speed of 9½ knots. The naming ceremony was gracefully performed by Mrs. Coull, of Newcastle.

Flamingo. On September 5th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 130 ft. by 22 ft. 3 in. by 12 ft. depth of hold. The vessel has been built to the order of Messrs. Pickering & Haldane's Steam Trawling Company, Limited, of Hull, and will be fitted with powerful triple-expansion engines, by Messrs. Amos & Smith of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Flamingo* by Miss Elsie Cartwright, of Hull, after which the company adjourned to the builders' offices, where cake and wine was served, and the customary toasts given and responded to.

Sandon Hall.—On September 5th there was launched from the west shipbuilding yard of Swan, Hunter, & Wigham Richardson, Ltd., Wallsend-on-Tyne, a steel screw steamer, named *Sandon Hall*, which has been built for the Hall Line service of the Ellerman Lines, Ltd. The principal dimensions of the vessel are:—Length overall, 412 ft.; beam (extreme), 50 ft. 2½ in.; depth (moulded), 32 ft. 3 in. The vessel has been designed to carry a deadweight cargo of about 8,300 tons on a moderate draught of water, and has been constructed to take the highest class of the British Corporation Registry. The machinery has been constructed by the Wallsend Slipway and Engineering Company, Ltd., and consists of a set of triple-expansion engines, having cylinders 24½ in., 42 in., 71½ in. by 48-in. stroke, steam being supplied by two large single ended boilers, working under Howden's system of forced draught. The vessel has been built under the supervision of Mr. Alexander Dalrymple, the superintendent engineer for the company.

Lady Furness.—On September 6th there was launched by the Blyth Shipbuilding Company, Ltd., a raised quarter-deck cargo steamer, with extra large hatchways, which has been built to the order of Sir Christopher Furness, M.P. She is classed 100 A1 at Lloyd's, under special survey, her dimensions being 235 ft. between perpendiculars by 34 ft. 6 in. by 17 ft. 3½ in. depth (moulded). She has cellular double bottom all fore and aft, her water ballast capacity being about 466 tons. The steamer has four powerful steam winches, two steel masts, with fore and aft rig, and four watertight bulkheads. Her cargo capacity is about 95,500 cubic ft., exclusive of bunkers, and she is estimated to steam 10 knots laden. The machinery is by the North Eastern Marine Engineering Company, Ltd., the cylinders being 19 in., 31 in., and 51 in. in diameter by 36-in. stroke. On leaving the ways the vessel was named *Lady Furness* by Mrs. R. J. Thompson, of Newcastle-upon-Tyne.

Charcas.—On September 17th there was launched on the Tyne a cargo steamer, which has been built to the order of Messrs. Grace Bros. & Co., Ltd., of London and New York. The vessel is 416 ft. 9 in. by 52 ft. 3 in., and carries over 8,000 tons on a moderate draught of water. Quadruple-expansion machinery is to be fitted by the Wallsend Slipway and Engineering Company, of sufficient power to propel her at a speed of 12 knots on a moderate consumption of fuel. As the vessel left the ways she was named *Charcas* by Miss Eyre, a daughter of one of the directors of the company, Mr. Edward Eyre, who accompanied his daughter.

Maude.—On September 18th Messrs. Irvine's Shipbuilding and Dry Dock Company, Ltd., launched from their shipyard at West Hartlepool a finely modelled steel screw steamer, built to the order of Messrs. Thomas Appleby & Co., West Hartlepool. She is of the following dimensions: 336 ft., by 47 ft., by 24 ft. 10 in. The vessel is built to Lloyd's highest class, under special survey, and is of the single-deck type, having poop, bridge, and topgallant forecastle. A double bottom is fitted throughout on the cellular principle, and the fore and after tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stringers, giving clear holds for the storing of bulky cargoes. Five water-tight bulkheads divide the holds into six water tight compartments, and wood grain divisions are fitted in the holds. She also has extra large cargo hatches, six steam winches, which are supplied with steam from a vertical multitubular donkey boiler, and is replete with all the latest improvements for rapid loading and discharging. A powerful, quick-warping steam windlass is fitted forward for the working of the cables, and steam steering-gear is fitted amidships, with hand-screw gear aft. Accommodation for captain and officers is arranged in houses on the bridge, and the seamen and firemen under topgallant forecastle. The sanitary, ventilating, and lighting arrangements have received special attention, and have been effected on the most approved lines. Engines of the triple expansion type are being supplied and fitted by Messrs. Blair & Co., Stockton, having cylinders 24 in., 40 in., 66 in., by 45-in. stroke, two large S. E. boilers, 160 lb. pressure. The vessel has been supervised during construction by Captain Baker. The christening ceremony was gracefully performed by Miss Baker, who named the vessel *Maude* as she left the ways.

Teno. On September 18th the steamship *Teno*, built to the order of the Compania Sud Americana de Vapores, was successfully launched from the yard of Earle's Shipbuilding and Engineering Company, Ltd., Hull. The dimensions of the ship are: Length, 340 ft.; breadth (extreme), 40 ft.; depth (moulded), 24 ft. She has been built of steel to Lloyd's 100 A1 Class, and is fitted for carrying a large quantity of water ballast in cellular double-bottom and aft-peak tank. The vessel will carry about 3,950 tons deadweight, and have a large capacity for cargo. She has a poop, bridge, and topgallant forecastle, two pole-masts of steel, each fitted with derricks, and all necessary cargo gear, including a 30-ton steel derrick stepped on deck for heavy lifts. There are six powerful steam silent winches of Earle's Company special make, two geared steam winches, and two steam coaling winches, by Messrs. Clarke, Chapman & Co.; steam windlass, by Messrs. Emerson, Walker & Thompson; and steam-steering gear, by Messrs. Davis & Co., fitted under bridge. The hatches are arranged at sides of vessel in pairs, with chafing bulkheads in 'tween decks and holds to allow of a rapid discharge of cargo into lighters. For bunkering the vessel, a system of cranes and shoots, operated from coaling-winches on bridge, has been adopted. A commodious house has been provided at fore end of bridge for captain's room and chart-room, the saloon is placed at fore end, under bridge, and the officers and engineers are also berthed on this deck in rooms at sides of casings, the petty officers, seamen, and firemen being accommodated in the forecastle. The machinery consists of a set of triple-expansion engines, with cylinders 23 in., 37 in., and 61 in. diameter, by 42-in. stroke, working at a pressure of 170 lb. per square inch, and supplied with steam by two large single-ended cylindrical boilers. Economy in coal consumption and in upkeep of engines and boilers has been carefully considered in the design of the machinery, all working parts and bearing surfaces being extra large. The naming ceremony was gracefully performed by Miss A. Dewsbury; and amongst those present were Mr. Dupont and Mr. Thomas Dewsbury (representing the Compania Sud Americana de Vapores), and Mr. Dupont, jun. The *Teno* is expected to sail shortly for her port of registry, Valparaiso, South America.

Bangarth.—On September 19th Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough, a fine steel screw cargo steamer, built to the order of Messrs. Rea Shipping Company, Ltd., of Liverpool. She has been specially designed to fulfil the requirements of the owners' extensive coal carrying trade, and is built on Harrowby & Dixon's, John Priestman's, and Livingston and Sanderson's patents, with top side water ballast tanks located under the deck between the sloping sides of the holds and the shell on each side of the vessel, and will be classed highest class at British Corporation. Her leading dimensions are: 282 ft. 6 in., by 40 ft. 3 in., by 23 ft. (moulded), and she will carry about 3,000 tons on a light draught of water. A large 'midship house is fitted for saloon, and captain, officers, and engineers' accommodation, &c., with chart and wheel-house on top, while the crew will be berthed in the forecastle. Water ballast will be carried in cellular double-bottom, all fore and aft, and in fore and aft peaks as well as in the top-side tanks. The vessel will also have four water-tight bulkheads, exceptionally large hatchways, and will be equipped with five powerful steam winches, steam windlass, and all the latest and most modern appliances for the rapid loading and unloading of cargo. Triple-expansion engines will be fitted by Messrs. John Dickinson & Sons, Sunderland, having cylinders 22 in., 35 in., and 59 in. by 39-in. stroke, supplied with steam by two large single-ended boilers, working at 180 lb. pressure. The vessel is being built under the superintendence of Mr. H. W. L. Shubrook, and Mr. W. M. Hawson, as resident inspector. On leaving the ways, she was gracefully named *Bangarth* by

Mrs. Alexander L. Rea, wife of one of the directors of the company.

Ellerslie. On September 19th a new screw steamer, named the *Ellerslie*, built to the order of Messrs. Hutchins Bros., Cardiff, was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields. The vessel is of the following dimensions: Length, 358 ft. 6 in. overall; breadth, 49 ft. 6 in.; depth (moulded), 27 ft. 11 in. She is of the improved single-deck type, to Lloyd's highest class, and is designed to carry a large cargo on a moderate draught, having a cellular double-bottom, all fore and aft, and fitted with poop, long bridge, and topgallant forecastle. Steel houses for captain and officers, and also for engineers and apprentices are constructed on the bridge deck, the crew being berthed in the forecastle. The vessel is also fitted up with grain feeders, in accordance with the Grain Cargoes Act. The vessel will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, having cylinders 25 in., 42 in., 68 in., and 45-in. stroke, supplied with steam by two large steel boilers, working at a pressure of 180 lb. per square inch.

Farley.—On September 19th an important launch took place from the yard of the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, the vessel being a finely moulded steamer, built to the order of Messrs. Houlder, Middleton & Co., London, for the Reliance Shipping Company, Ltd., this being the fourth of a fleet of steamers building by the same firm for this new company. The steamer is 372 ft. long, by 48 ft. beam, by 30 ft. 10 in. deep, and has been built under special survey to the highest class at Lloyd's spar deck rule, with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation, which is very ample, being placed in steel houses on the bridge deck. The 'tween decks are lofty, and so arranged that cattle, troops, or emigrants, may be carried, if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of eight steam winches, by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne; a large number of cargo derricks and steam windlass, by Messrs. Emerson Walker & Thompson Brothers. She is fitted, of course, with the usual water ballast arrangements for light passages, and will be lighted throughout by electricity. She has been constructed to a fine model, with a view to rapid speed and economy in fuel, and the machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., and 69 in., by 48 in. stroke, three large steel boilers, 14 ft. by 10 ft. 9 in., at 180 lb. pressure. The vessel will carry about 7,300 tons deadweight, and steam about 10 knots speed, loaded, at sea. The christening ceremony was gracefully performed by Mrs. Freeland, who named the vessel the *Farley* as she commenced moving down the ways.

Tangistan. On September 19th Messrs. William Gray & Co., Ltd., launched, at West Hartlepool, the large steel screw steamer *Tangistan*, which they have built for Messrs. Frank C. Strick & Co., Ltd., of Swansea and London. The vessel will take the highest class in Lloyd's, and is of the following dimensions, viz.: Length overall, 361 ft. 6 in.; breadth, 49 ft. 3 in.; and depth, 26 ft. 9½ in. She is a handsomely modelled vessel of the strengthened spar-deck type, with two decks and poop, long bridge, and forecastle. Very tasteful cabin accommodation is being fitted in houses on the bridge-deck for passengers, captain and officers, and electric lighting is fitted throughout. The vessel has a cellular double-bottom, and after-peak tank for water ballast. The decks are of steel and iron, and the whole of the outfit, including steam windlass, steam-steering gear, nine steam winches, with return exhaust, and marine-type donkey boiler, are of the most approved description. The machinery is made by the Central Marine Engine Works of the builders, being of the triple-expansion type, with cylinders 24-in., 46 in., and 65 in., with a piston stroke of 42 in., and two large steel multitubular boilers, working by Howden's Forced Draught, at a pressure of 180 lb. per square inch. The vessel and machinery have been constructed under the superintendence of Mr. Archibald Walker, on behalf of the owners, and the ceremony of naming the steamer *Tangistan* was gracefully performed by Mrs. Bastow, of Ashbank, Harrogate.

Kittiwake. On September 19th the ss. *Kittiwake*, the latest addition to the fleet of the Cork Steamship Company, of Cork, was launched from the Neptune Shipyard of Swan, Hunter & Wigham Richardson, Ltd. This vessel is intended for the service between Manchester, Liverpool, and Dutch and Belgian ports. She is 290 ft. in length by 38½ ft. beam, and will carry 2,800 tons of deadweight. The engines and boilers are also being constructed at the Neptune works, and are designed to drive the vessel at a speed of 11½ knots per hour. There is also a very complete equipment for loading and discharging cargo, including a steam winch and nine steam cranes, as well as all the modern appliances for the working of the ship. The owners were represented at the launch by Mr. Joseph Pike, of Cork, the chairman of the company, Mr. Ebenezer Pike, a director of the company, Mr. R. B. Reynolds, of Cork, the secretary, and Captain Hore, and Mr. J. A. Flockhart, of Liverpool, were also present. As the vessel left the ways the christening ceremony was gracefully performed by the niece of the chairman, Miss Pike Pease, of Richmond, Yorkshire.

Agamemnon. On September 20th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 117 ft. by 22 ft. by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Messrs. The Consolidated Steam Fishing and Ice Company (Grimsby), Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened *Agamemnon* by Mrs. Frusher, of Grimsby, after which the company adjourned to the builders' offices, where cake and wine were served, and the customary toasts given and responded to.

Halfdan. On September 20th there was launched from the yard of the Sunderland Shipbuilding Company, Ltd., a steel screw steamer, 240 ft. between perpendiculars, by 36½ ft. breadth (extreme), by 19 ft. deep, having poop, long bridge, and topgallant forecastle, classed 100 A1 Lloyd's, under special survey, single-deck type. The vessel is built to carry 2,250 tons deadweight. Accommodation is placed on the bridge for captain and engineers, and for sailors and firemen in forecastle, with saloon amidships, fitted up in polished hardwoods. The vessel has a large donkey boiler for driving the deck machinery, five steam winches, steam steering gear, and direct steam windlass. The main engines are by the North Eastern Marine Engineering Company, Sunderland, and have cylinders 18 in., 29 in., 48 in. by 33-in. stroke, steam being supplied by a large boiler, working at a pressure of 180 lb. per square inch. The vessel has been built to the order of L. H. Carl Esq. of Copenhagen, and during construction has been inspected by Mr. A. B. Kaempe, of Copenhagen. On leaving the ways the steamer was gracefully named *Halfdan* by Messrs. Robkirk, of Newcastle.

Screw Steamer. On September 20th a new steel screw steamer was launched from the yard of Messrs. R. Williamson & Son, Workington. The principal dimensions are: Length, 140 ft.; breadth, 23 ft. 10 in.; depth (moulded), 11 ft. 9 in.; and is designed to carry 480 to 490 tons on Lloyd's freeboard. The vessel is built to the highest class at Lloyd's, and will be propelled by engines of the compound surface-condensing type, having cylinders 19 in. and 38 in. with a stroke of 27 in., steam being supplied by a cylindrical steel boiler, 12 ft. 6 in. diameter by 10 ft. long, working at a pressure of 126 lb. The vessel has been built by the above builders, and, if unsold on completion, it is their intention to run in the coasting trade.

Glamorgan. On September 21st Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby shipbuilding yard, Thornaby-on-Tees, a handsomely modelled steel screw steamer of the following dimensions: 352 ft. by 51 ft. by 25 ft. 1½ in. depth (moulded); single-deck type, and built to the highest class in Lloyd's, under special survey, with poop, bridge, and topgallant forecastle; water ballast in double bottom fore and aft, and in peaks; is rigged as a fore and aft schooner, and equipped with six large double-powered steam winches, with additional derrick posts, and derricks, to facilitate rapid loading and discharging, steam-steering gear, steam windlass, of the quick warping type, screw gear aft, and all modern improvements. She is equipped with shifting boards throughout in the holds for carrying grain cargoes. The accommodation is provided in large central deckhouse for captain, saloon, &c., the officers and engineers being in houses alongside engine casing, and the crew in the forecastle. Her engines have

been constructed by Messrs. John Dickinson & Sons, Ltd., Sunderland, the cylinders being 24½ in., 40 in., 66 in. by 45 in., with two large steel boilers, working at 180 lb. pressure. The vessel has been built to the order of Messrs. Jenkins, Bros., of Cardiff, and as she left the ways she was gracefully christened the *Glamorgan* by Mrs. James Jenkins, wife of one of the owners.

Veraston. On September 21st Messrs. William Gray & Co., Ltd., launched, at West Hartlepool, the handsome steel screw steamer *Veraston*, which they have built for Messrs. Walter Scott & Co., of West Hartlepool. She will take the highest class at Lloyd's, and is of the following dimensions:—Length overall, 291 ft.; breadth, 40 ft.; and depth, 20 ft. 7½ in., with long bridge, poop, and topgallant forecastle. The saloon, state-rooms, captain's, officers', and engineers' rooms, &c., will be fitted up in houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom, and aft peak ballast tank, five steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large patent vertical multitubular donkey boiler, shifting boards throughout, stockless anchors, boats on beams overhead, telescopic masts with fore and aft rig, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 20 in., 31½ in., and 53 in. diameter, with a piston stroke of 36 in., and two large steel boilers, for a working pressure of 160 lb. per square inch. The ship and machinery have been constructed under the superintendence of Mr. T. C. Nevison, on behalf of the owners, and the ceremony of naming the steamer *Veraston* was gracefully performed by Mrs. Scott, Greenpark, West Hartlepool, wife of the managing owner.

Edmonton.—Lately there has been launched on the Tyne a steamer, built to the order of the Mathews Steamship Company, Ltd., of Toronto. The vessel is of the following dimensions:—Length, 256 ft.; breadth, 42 ft. 6 in.; depth (moulded), 23 ft., and has been built in accordance with the rules of the British Corporation. She has a deadweight capacity of about 2,000 tons on a light draught. The engines are supplied by the North Eastern Marine Engineering Company, Ltd., Wallsend, and consist of a set of triple-expansion vertical surface-condensing engines of the most modern design. They are supplied with steam from two boilers of the Scotch marine type, having a working pressure of 185 lb. per square inch. She was named *Edmonton* by Miss Grand, of London.

Port Phillip.—Lately there was launched at Hebburn-on-Tyne, by Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., the third of three sister ships built by them for Messrs. Wm. Milburn & Co., of Newcastle and London. The vessel is intended for the Australian trade of the Anglo-Australasian Steam Navigation Company, and was named *Port Phillip* as she left the ways. She is 393 ft. overall, by 49 ft. beam by 28 ft. 6 in. depth (moulded), and is built under Lloyd's survey, to take the highest class on the three-deck shelter deck rule. The propelling machinery is being constructed at Messrs. Hawthorn, Leslie & Co.'s machinery department. It consists of a set of triple-expansion single-screw engines, with cylinders 27 in., 45 in., and 74 in. by 45-in. stroke, with steam supplied by two main boilers and one auxiliary boiler, all working at a pressure of 180 lb., and which will be of ample size to drive the vessel at a speed of 11 knots at sea. Wailes, Dove & Co.'s bitumastic enamels were applied to the tank in boiler-room and lower bunkers, and their bitumastic covering to the tank top in the boiler room.

LAUNCHES—Scotch.

Star of Liberty.—On August 18th there was launched at Aberdeen, for the Walker Steam Trawl Fishing Company, Ltd., of Aberdeen, a steel ketch-rigged steamer of about 195 tons gross, named *Star of Liberty*.

Screw Steamer.—On August 23rd, at Alloa, there was launched from the yard of Messrs. Mackay Bros., a steel screw steamer of 2,250 tons deadweight, built to the order of Messrs. Pile & Co., London. The vessel left immediately under tow for Sunderland, where she will be engined by Messrs. MacColl & Pollock, Ltd.

Muncaster Castle.—On August 24th there was launched at Port Glasgow a steel screw steamer of the following dimensions:—Length overall, 412 ft. 6in.; breadth 50 ft.; depth 29 ft. 10 in.; and gross tonnage 4,700. The steamer has been built under Lloyd's special survey for 100 A1 class, is fitted with all the latest appliances for the rapid handling of cargo, and will be engined in Glasgow by Messrs. David Rowan & Co. The machinery consists of triple-expansion engines, having cylinders 26 in., 44 in., and 73 in. in diameter by 48-in. stroke. The vessel has been built to the order of the Lancashire Shipping Company, Ltd., of Liverpool, and was named *Muncaster Castle* by Mrs. Walter Chambers, Liverpool.

Ramon Corral.—On August 24th Messrs. Lobnitz & Co. launched from their yard at Renfrew the steel screw tug *Ramon Corral* to the order of Messrs. S. Pearson & Son, for the Tehuantepec National Railway Company. The vessel, which is being built under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London, Liverpool, and Rotterdam, is 100 ft. long by 20 ft. breadth, by 12 ft. depth (moulded), and is to be classed 100 A1 at Lloyd's. She is being fitted with very powerful towing gear, and with electric light throughout, including projector, of Suez Canal type, and a complete salvage pump installation. The propelling machinery, which is also being built by Messrs. Lobnitz, will consist of triple-expansion engines, having cylinders 13 in., 22 in., 35 in. by 27-in. stroke, taking steam from one boiler of ample size working at a pressure of 160 lb. The vessel is also fitted for burning oil fuel, under the Flannery-Boyd system.

Atlantico.—On August 27th there was launched at Bowling, by Messrs. Scott & Sons, a powerful screw tug, named *Atlantico*, built to the order of Messrs. Ross & Duncan, of Govan, for foreign owners.

Dredger.—On August 30th there was launched at Paisley, by Messrs. Fleming & Ferguson, Ltd., a powerful bucket dredger, which they have built for the Thames Conservancy Commissioners. The vessel is the first instalment of the order for dredging plant placed by the Conservators with this firm for the carrying out of improvements on the river. The dimensions of the new dredger are:—233 ft. by 37 ft. by 12 ft., and she will be capable of raising 1,200 tons of ordinary material per hour from a depth of 50 ft. below water level.

Devonia.—On August 31st there was launched from the yard of Scott of Kinghorn, Ltd., a screw steamer built to the order of the Anglo-French Steamship Company, Ltd., Devonport for their cargo and passenger trade between Plymouth, Guernsey, and St. Brieux, Brittany. The vessel will carry 300 tons deadweight at a speed of 11 knots per hour. She has sleeping accommodation for forty-five passengers, will carry on deck 200 passengers, and is fitted throughout with electricity. She was named the *Devonia* by Mrs. Heath, wife of one of the owners.

Asia.—On September 3rd there was launched at Dumbarton, by Messrs. William Denny & Brothers, the three-masted square-topsail schooner *Asia*, which they have built to the order of the Navegacion a Vapor Nicolas Mihanovich, of Buenos Ayres. The dimensions of the vessel are 215 ft. by 38 ft. by 11 ft. 6 in., and she is designed to carry a considerable deadweight on limited draught. The accommodation provided is suitable for the warm climate in which the vessel will trade. In order to facilitate the handling of cargo, the hatches are specially large, and at each a powerful steam winch is fitted, steam being supplied by a large donkey boiler amidships. A feature which is somewhat unusual in sailing ships is a navigating bridge fitted across the roof of one of the deckhouses. From this the vessel is steered and controlled in a manner similar to steamers. The arrangement has been found by the owners to be specially suitable for river navigation. Miss Helen K. Ward, Garmoyle, Dumbarton, named the vessel.

Crown.—On September 3rd there was launched at Port Glasgow, by Messrs. A. Roger & Co., on the Clyde, a steamer which has been built for Messrs. William Thomas Sons & Co., Liverpool. The dimensions of the vessel are:—Length, 385 ft.; breadth, 50 ft.; depth, 27 ft. 6 in.; with a carrying capacity of 7,300 tons. The vessel was named *Crown*.

Dalhanna.—On September 3rd there was launched at Greenock, by Scott's Shipbuilding & Engineering Company, the steel screw steamer *Dalhanna*, which they have built to the order of Messrs. J. M. Campbell & Sons, shipowners, Glasgow. The *Dalhanna* is a vessel of 4,600 tons gross, with a deadweight carrying capacity of 7,500 tons. Engines and machinery will be supplied by the builders. The vessel was named by Mrs. John Campbell, Hughenden House, Irvine.

Setter.—On September 4th there was launched at Greenock, by Scott's Shipbuilding & Engineering Company, Ltd., the second of the two steamers being built to the order of Messrs. G. & J. Burns, Ltd., for the Glasgow and Manchester trade. The steamer was named the *Setter* by Lord Inverclyde's second daughter, the Hon. Muriel Burns. The dimensions of the steamer are:—233 ft. by 33 ft. by 16 ft. 6 in. (moulded).

Volturno.—On September 5th there was launched at Govan, by the Fairfield Shipbuilding & Engineering Company, Ltd., a twin-screw steamer 340 ft. by 43 ft. by 31 ft. 3 in. for the Navigazione Italo-Americana (De Martino & Co.), of Naples. The vessel, which is classed in the British Corporation Registry, is intended for the company's trade between Italy and America. Accommodation is provided for about 1,500 emigrants and about twenty-four saloon passengers. The vessel has been built to the latest requirements of the Italian Emigration Committee, particular care having been given to the sanitary and ventilation arrangements. The space occupied by emigrants is ventilated and heated by the thermo-tank system, and the installation is such that the whole volume of air contained in the respective spaces can be changed at least six times per hour, and a temperature of 65 deg. Fahr. maintained with the atmosphere at 12 deg. Fahr. The propelling machinery consists of two sets of inverted triple expansion engines, each with three cylinders and three cranks. The high-pressure cylinders have piston valves, and the intermediate and low pressure cylinders are fitted with double-ported flat slide valves, all worked by the usual link motion. The cylinders are supported by cast-iron columns, and the condenser, which is also of cast-iron, is incorporated with the framing of the engines. The crank shafts are of the built type, and with the thrust, tunnel, and propelling shafting are of forged steel. Steam is supplied at a pressure of 180 lb. by two large single-ended boilers fitted with Howden's system of forced draught. There is a full equipment of auxiliary machinery, including a large evaporator and distilling condenser to provide fresh water. The circulating pumps are driven by independent engines, and are fitted with a suction from the bilge to enable them to quickly discharge a large quantity of water from the vessel should this be necessary at any time. The vessel was named *Volturno*.

Ban Hong Liong.—On September 6th there was launched at Montrose, by the Montrose Shipbuilding Company, the steamer *Ban Hong Liong* which they have built for the steamship company of that name in Singapore. The vessel, which is registered at London, and has been built to Lloyd's 100 A1 class, is 237 ft. long overall, 35 ft. breadth (moulded), and 16 ft. 10 in. depth (moulded). She will be fitted up as a modern first-class cargo steamer, and with all the latest improvements for expeditiously handling and conveying cattle. She will be supplied with triple-expansion engines by Earle's Shipbuilding and Engineering Company, Hull.

Ailsa Craig.—On September 6th there was launched at Troon, by the Ailsa Shipbuilding Company, Ltd., a steel screw steamer for Messrs. Hugh Craig & Co., Belfast, for their general coasting trade. The dimensions of the vessel are:—Length overall, 191 ft. 6 in.; length between perpendiculars, 184 ft. 6 in.; breadth (moulded), 27 ft. 6 in.; depth (moulded), 13 ft. 7½ in.; and deadweight carrying capacity, about 740 tons. The vessel is to be fitted with compound direct-acting engines, having cylinders 21 in. and 44 in. diameter respectively, with a stroke of 30 in. by Messrs. Muir & Houston Ltd., Glasgow. As the vessel left the ways she was named *Ailsa Craig* by Miss Lewis, of Belfast.

Eugenia.—On September 7th there was launched at Port Glasgow, by Messrs. Russell & Co., a steamer of 7,350 tons deadweight and of the following dimensions:—Length, 385 ft.; breadth, 49 ft. 9 in.; and depth, 29 ft. She has been built to the highest class at Lloyd's and Austrian Veritas for Messrs. Cosulich & Co., of Trieste. Messrs. D. Rowan & Co., Glasgow, supply the engines, the cylinders of which are 26 in., 42 in., and 70 in. by 48-in. stroke. The vessel was named *Eugenia*.

Strathord.—On September 7th there was launched by the Grangemouth and Greenock Dockyard Company, the steamer *Strathord*, which they have built for Messrs. Burrell & Son, Glasgow. Her dimensions are:—230 ft. by 52 ft. by 28ft. 6 in., and she has a deadweight carrying capacity of 7,100 tons. The naming ceremony was performed by Miss Burrell, daughter of Mr. George Burrell, one of the owners. The engines will be supplied by Messrs. Kincaid & Co., of Greenock.

Tabaristan.—On September 8th there was launched at Port Glasgow, by Messrs. William Hamilton & Co., Ltd., a steel screw passenger and cargo steamer for Messrs. F. C. Strick & Co., Ltd., London. The vessel is 370 ft. by 45 ft. by 26 ft. 10 in. (moulded), and is designed to carry about 5,300 tons on about 22 ft. draught. She has been built to Lloyd's highest class, and has cargo poop, bridge and top gallant forecastle, teak decks, and all the latest appliances for the rapid handling of cargo. The passenger accommodation is situated amidships, and is handsomely fitted up. The vessel is lighted throughout by electricity. Triple expansion engines for a speed of 11 knots on service are being supplied by Messrs. D. Rowan & Co., Glasgow. The steamer was named *Tabaristan* by Miss Bessie Cockburn, Newlands, Glasgow.

Zealand. On September 15th there was launched at Whiteinch, by Messrs. Barclay, Curle & Co., Ltd., a steamer which they have built to the order of Sir Donald Currie, G.C.M.G. The vessel is intended for the service of the Liverpool & Hamburg Steamship Company, Liverpool. The principal dimensions of the vessel are:—Length (between perpendiculars), 260 ft.; breadth (extreme), 36 ft.; depth (moulded), 24 ft. 6 in. She is built of steel, and will class 100 A1 Lloyd's. She will measure about 1,700 tons gross register, and will carry about 2,500 tons deadweight. Water ballast will be carried in a cellular double bottom, fitted all fore and aft. The erections above the spar-deck consist of a forecastle forward, and a bridge house amidships, in which accommodation is arranged for officers, engineers, crew, and a few space state-rooms, a house being fitted above the bridge for the captain and navigating quarters. There are four large cargo holds served by six powerful steam winches and nine derricks. The propelling machinery is being supplied by the builders, and consists of one set of triple-expansion engines, having cylinders 20½ in., 34 in., and 55 in. diameter with a stroke of 42 in., and supplied with steam by two single-ended boilers 14 ft. 6 in. in diameter by 10 ft. long, of which the working pressure is 180 lb. The vessel was named *Zealand* by Miss Winifred Maclean, daughter of Mr. Andrew Maclean, managing director of the builders' firm.

Crown of Calicia.—On September 17th Messrs. Alexander Stephen & Sons, Ltd., launched from their yard at Linthouse a large cargo steamer for Messrs. Prentice, Service & Henderson, of the "Direct Line," trading from Glasgow to the West Indies. The principal dimensions are as follows: Length, 400 ft.; breadth, 52 ft.; depth (moulded), 29 ft. 9 in.; and she has been designed under the British Corporation rules to carry about 8,000 tons deadweight on a moderate draught. She has a very large cubic capacity, and all her fittings have been arranged for the handling and reception of large and bulky cargo. Her fittings have been arranged under the supervision of Mr. Niccol, naval architect, of Glasgow; and to suit the special requirements of her intended trade. To facilitate the handling of cargo, much of which in the West Indies is unloaded into barges alongside the ship, Messrs. Prentice, Service & Henderson have again adopted their system of twin masts, which combines all the advantages of Samson posts, with the extra height and strength of ordinary masts, and enables the vessel to deal unaided with bulky machinery of enormous weight, lifting it out of the holds and putting it clear over the side. The propelling machinery, which is also being constructed at Linthouse, will consist of a set of triple-expansion engines, with cylinders 26 in., 42 in., and 70 in. diameter, by 54-in. stroke, supplied with steam from three single-ended boilers, working at 180 lb. pressure with Howden's Forced Draught. The vessel was named the *Crown of Calicia* by Mrs. George W. Service, Myrtle Park, Cove.

America.—On September 18th there was launched at Port Glasgow, by Messrs. Murdoch & Murray, a large sailing schooner, the first of two which the firm have in order for Mr. Nicholas Mihanovich, Buenos Ayres. The dimensions of the vessel are:—Length, 210 ft. by 37 ft. by 11 ft. (moulded). The vessel is classed in Lloyd's, and has exceptionally large hatches and practically clear holds to fit her for trading on the River Plate. The vessel was named *America* by Miss Wiggins, daughter of the superintendent to the company.

Agawa. On September 20th Messrs. Ramage & Ferguson, Ltd., Leith, launched from their yard a finely modelled steel screw steam yacht, of about 700 tons yacht measurement, built to the order of Mr. C. W. Harkness, New York, from the designs and under the superintendence of Messrs.

Cox & King, 5, Suffolk street, Pall Mall, London. The principal dimensions of this yacht are: Length overall, 214 ft.; breadth, 27 ft. 6 in.; and depth (moulded), 16 ft. 9 in. The yacht is constructed of steel to Lloyd's highest class, with awning deck extending full width of vessel and for about two-thirds of the length with chart-house and navigation bridge placed above same. Under the awning deck is a long range of deckhouses, with drawing-room, finished in rich hardwood at aft end, and passage leading forward to a large dining-room. The state-rooms, which are fitted in choice hardwoods, and handsomely furnished, are situated below the main deck, the owners private rooms being forward of the machinery space and his guests' rooms abaft same. The yacht is fitted complete with all the most modern equipment, including steam windlass and capstan forward, steam warping capstan aft, combined steam and hand-steering gear, electric light, steam heating, refrigerating machinery, &c. The propelling machinery consists of a set of four-crank triple-expansion engines, with cylinders 17 in., 27 in., and two 31 in. diameter by 27-in. stroke, steam being supplied from two large single-ended boilers, working up to 180 lb. pressure. On leaving the ways the yacht was named *Agawa* by Mrs. Harkness. This is the fourteenth yacht built by Ramage & Ferguson, Ltd., to the designs of Messrs. Cox & King, and they have two other yachts on the stocks for the same designers.

Singapore.—On September 20th Messrs. Archibald McMillan & Son, Ltd., Dumbarton, launched the steel screw steamer *Singapore*, which is another of the steamers built for Sir John Jackson, to run under the Westminster Shipping Company, in connection with his South African, Singapore, and other Government contracts. The dimensions are:—Length 372 ft.; breadth 50 ft.; depth, 28 ft. 6 in.; and she is designed to carry a large deadweight on a moderate draught. Machinery is being supplied by the Clyde Shipbuilding & Engineering Company, Ltd., Port Glasgow. The vessel and machinery have been built to Lloyd's highest class. The steamer was christened by Lady Jackson. Sir John Jackson and Mr W. Parker, of London, were amongst those who witnessed the ceremony.

LAUNCHES—Irish.

Berne.—On August 23rd there was launched at Dublin a steamer named *Berne*, which has been built to the order of Mr. John Harrison, of London. The dimensions are: Length between perpendiculars, 220 ft. by 34 ft. by 15 ft. 6 in. depth moulded. She has a deadweight capacity of upwards of 1,500 tons on Lloyd's freeboard, and at a mean draught not exceeding 14 ft. 6 in. She is built of steel to the highest class at Lloyd's, and is fitted with cellular double bottom for water ballast throughout the entire length of the holds, and also deep tanks for water ballast in both forward and aft peaks. Her gross register tonnage is about 1,016, and the net register 500. The vessel is of the raised quarter-deck type, with machinery placed aft. The vessel will be fitted with triple-expansion engines at Glasgow.

Rohilla.—On September 6th this fine large twin-screw passenger steamer was launched at Belfast by Messrs. Harland & Wolff. The *Rohilla*, which has been built to the order of the British India Steam Navigation Company, Limited, is 460 ft. long by 56 ft. beam, and about 7,000 tons gross. The new vessel has been built to Lloyd's 100 A1 classification. She will have superior accommodation for a large number of passengers, most of the state-rooms being arranged on the "tandem" principle. The vessel will have large cargo capacity, also spacious refrigerated chambers, and will be fitted throughout with electric light and other appliances of the latest and most improved type. The owners were represented at the launch by Mr. Peter Barr.

TRIAL TRIPS.

Republic.—On August 24th the new steamer *Republic* (of which we gave particulars in our July 13th issue, page 603), built by the Sunderland Shipbuilding Company, Ltd., and engined by the North Eastern Marine Engineering Company, Limited, Sunderland, was taken to sea on her official loaded trial. The vessel has been built to the order of Messrs. W. H. Cockerline & Co., of Hull, Mr. G. H. Strong, consulting engineer, under whose superintendence the vessel was built, was present on the trial trip, and expressed himself as highly satisfied with the efficient working of the machinery, and the speed result obtained.

San Cristobal.—On August 25th this vessel (of which we gave particulars in our September issue, page 63) was taken out for her trial trip, under liquid fuel conditions, from the Walker Yard of Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., and attained a mean speed of over 10 knots. She has been constructed to the order of Messrs. Flannery, Baggallay & Johnson, of London, Liverpool, and Rotterdam, for the carriage of oil in bulk.

Karnak.—On August 28th the ss. *Karnak*, built by Messrs. John Blumer & Co., North Dock, Sunderland, to the order of the Moss Steamship Company, Limited, of Liverpool, ran a successful trial. Her dimensions are:—Length, between perpendiculars, 336 ft.; breadth (extreme) 47 ft.; depth (moulded) to spar-deck 26 ft. 6 in. The vessel averaged 11½ knots with all water ballast tanks full, including deep tank, and about 800 tons bunker coal. The engines and boilers have been constructed by Messrs. The North Eastern Marine Engineering Company, Limited, Sunderland, the cylinders being 24 in., 40 in., 67 in. by 42-in. stroke, with two large steel boilers of 180 lb. pressure. The steamer is intended for the Constantinople and Alexandria trade of her owners, and in addition to being fitted with every modern convenience for that trade, she has accommodation for a number of passengers, for whom a large and handsomely fitted saloon-house is placed amidships, with berths adjoining. The engineers and officers are accommodated in comfortable side-houses at the after end of the bridge deck. The ship is fitted throughout with electric light, which has been installed by Messrs. Boothroyd, Hyslop & Co., Ltd., of Liverpool. At the conclusion of the trial trip, which was most satisfactory in every respect, the ship sailed for Liverpool, there to load for her first voyage. Both ship and engines have been constructed under the superintendence of Messrs. William Esplen & Son, Liverpool, who were represented on the trial trip by Mr. John Esplen. Mr. William Moss was also present.

Bramley.—On August 29th the finely modelled steel screw steamer *Bramley* (of which we gave particulars in our June 15th issue, page 509), built by the Northumberland Shipbuilding Company, Limited, Howdon-on-Tyne, and engined by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, to the order of Messrs. Houlder, Middleton & Co., London, for the Reliance Shipping Company, Limited, left the Tyne for her trial trip, which proved in every way satisfactory, and a speed of 11 knots was easily obtained. Among those present on board were the following:—Mr. Bunclark and Captain Butler, representing the owners; Mr. J. Graham, representing the builders; Mr. Harrison, representing the engineers.

Aydon.—On August 30th the ss. *Aydon*, which has been built for Messrs. Adam Bros., of Newcastle, by Swan, Hunter & Wigham Richardson, Ltd., was taken to sea for her trial trip. The vessel is of the following leading dimensions:—Length, 331 ft.; beam (extreme), 49 ft.; depth (moulded), 25 ft. 3 in. She has been built to take Lloyd's highest class, three deck grade, and to carry a deadweight of 5,860 tons on a draught of 21 ft. 9 in. The machinery has been constructed by the Wallsend Slipway and Engineering Company, Limited, and consists of a set of triple-expansion engines, having cylinders 23½ in., 39½ in., 65 in. by 42 in. stroke; steam being supplied by two single ended boilers, working at 180 lb. pressure. On the trial trip a speed of nearly 10½ knots was attained on the measured mile. The owners were represented on the trial by Mr. J. B. Adam, Mr. Jas. Adam, and Mr. Tom Adam, also by Mr. Hall, their superintending engineer, who expressed themselves highly satisfied with the performance of the steamer.

Comtesse de Flandre. On August 30th the fine new steel screw steamer *Comtesse de Flandre*, built by Messrs. W. Dobson & Co., Low Walker-on-Tyne, to the order of Messrs. Ocean Société Anonyme Belge d'Arnement et de Navigation, of which Messrs. L. Dens & Co., of Antwerp, are the managers, left the Tyne for her official trial trip. The dimensions of the steamer are 280 ft. by 42 ft. by 28 ft. 7 in., with shelter deck, and she has been thoroughly equipped with all the latest appliances for ventilation, and for the service of the Ocean Line between Tyne, Antwerp, London, and Mediterranean ports, with general cargo, fruit, &c. The propelling machinery, which has been constructed by Messrs.

The North Eastern Marine Engineering Company, Limited, at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple-expansion engines, having cylinders 22 in., 37 in. and 61 in. diameter, with stroke of 39 in., steam being supplied by three large steel boilers, working at a pressure of 180 lb. per square inch. On a number of runs over the measured mile, the machinery worked without the slightest hitch, and a speed slightly in excess of the guarantee speed was easily maintained, great satisfaction at the vessel's performance being expressed by those on board, amongst whom were Mr. Doris, managing owner, Mr. J. M. Burnlee, under whose supervision both hull and machinery have been constructed, Mr. Armstrong, of Messrs. Armstrong, Lord & Co., agents for the owners, Mr. J. Reid, Belgian Consul for Newcastle, Mr. H. and Mr. W. Dobson, representing the shipbuilders, and Mr. D. Myles, representing the enginebuilders.

Corte.—On September 1st the fine passenger steamer *Corte* of which we gave particulars in our September issue, page 28, went for a very successful trial trip off the coast. The steamer has been built and engined at the Neptune Works of Swan, Hunter & Wigham Richardson, Ltd., for the mail and passenger service carried on by Messrs. Fraissinet, of Marseilles, between Corsica and the mainland. On the trial trip the machinery worked without the slightest hitch, a mean speed of 18½ knots per hour being obtained.

Antigone. On September 5th the steel screw steamer *Antigone* (of which we gave particulars in our August issue, page 28), built by Messrs Craig, Taylor & Co., Ltd., Stockton-on-Tees, and engined by the North Eastern Marine Engineering Company, Sunderland, to the order of the Egypt and Levant Steamship Company, Limited, of London, Messrs. Alfred Lanning & Co., London, was taken to sea for her trial trip, which proved highly satisfactory. Over a course of 17½ miles a speed of 12 knots was maintained. The owners were represented by Mr. W. H. Robson, the superintendent engineer, who expressed himself as being highly pleased with the ship and engines. After the trial trip the vessel proceeded to Howdon Dock, Tyne, under the command of Captain J. DeVine.

King George. On September 6th the large steel screw steamer *King George* (of which we gave particulars in our September issue, page 64), built by R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough, and engined by Messrs. Blair & Co., Ltd., Stockton-on-Tees, for the Glasgow King Shipping Company, Limited (managers, Messrs. John A. Walker & Co), proceeded to sea for her official trials. The results were pronounced satisfactory to all concerned, the vessel registering a speed of 12 knots in full ballast condition. A special feature of this vessel's construction is the arrangement of clear holds, the deck being supported upon girders and wide-spaced mast pillars, placed well clear of hatch sides.

King Idwal. On September 6th the new screw steamer *King Idwal* (of which we gave particulars in our September issue, page 63), built and engined by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of the King Line, Limited (Messrs. Philipps, Philipps & Co., London, managers), was taken to sea on her official trial trip. After several runs over the measured mile, the vessel attained an average speed of 11½ knots, the trial being in every way successful and satisfactory to all concerned. The vessel afterwards returned to the Tyne to load for Genoa. Among the company present were Mr. George Dodd, representing the owners; Mr. Robert Readhead, Mr. John Readhead, Mr. Lohden, Newcastle, Mr. W. B. Cumming, and Captain Williams, who will take command of the vessel.

Fornebo.—On September 7th the ss. *Fornebo* of which we gave particulars in our September issue, page 64), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesbrough, and engined by the North Eastern Marine Engineering Company, Sunderland, proceeded to sea for her official trials, which passed off most successfully, and the vessel, under the command of Captain Hensen, proceeded on her maiden voyage to the Baltic to load about 2,400 standards of deal for Alexandria, whence she goes in ballast to the Black Sea, and from there returns home with a cargo of grain in bulk.

Ripon. On September 7th the finely modelled steel screw steamer *Ripon* (of which we gave particulars in our September issue, page 63), launched by Irvine's Shipbuilding and Dry Docks Company, Ltd., West Hartlepool, and engined by Richardsons, Westgarth & Co., Ltd., and specially built for the Furness Line of steamers for their Halifax and London service, proceeded to sea on her trial trip. The vessel has been supervised during construction by Mr. T. Tose, owners' superintendent. After adjusting the compasses, the vessel was run full speed, 12 knots being attained, the engines working smoothly and well, the vessel displaying good sea qualities, and giving every satisfaction. The vessel then proceeded to Fowey, in command of Captain James Doherty.

Alexandra. On September 8th the handsome steel screw steamer *Alexandra* (of which we gave particulars in our August issue, page 28), built by Messrs. William Gray & Co., Ltd., and engined at the Central Marine Engine Works of the builders, for Messrs. C. Nielsen & Sons, West Hartlepool, had her trial trip. The owners were represented by Mr. Hans C. Nielsen, Mr. R. Nielsen, Mr. Rupert Nielsen, jun., and Mr. Peter Balmsen, the latter gentleman having superintended the construction of ship and machinery. In the absence of Captain J. E. Murrell, Mr. William C. Borrowman represented the builders. Fortunately for the securing of reliable results, the vessel was fully loaded, and the anticipations of both builders and owners were exceeded. The mean speed over the double run from West Hartlepool to Souter Point was over 10 knots, and the performance of both ship and machinery was highly satisfactory.

Ethyl.—On September 11th the ss. *Ethyl* (of which we gave particulars in our August issue, page 28), built by Messrs. Ropner & Son, Stockton-on-Tees, and engined by Messrs. Blair & Co., Ltd., Stockton-on-Tees, to the order of Messrs. W. Tulley & Co., Hull, made her official trial trip in the Tees Bay, when she averaged a speed of 11 knots, the engines working very satisfactorily. The vessel has been built under the superintendence of Mr. J. L. Richardson, of Hull, Captain R. E. Tether being in command of the vessel during trial. The trial was in every way satisfactory, Mr. Tulley, the managing owner, who was present at the trial expressing himself as highly pleased with the vessel. Mr. J. R. Garthwaite was present on behalf of the builders of the vessel, whilst Mr. Shepherd represented the engine builders.

Mathilda.—On September 12th, the large steel screw steamer *Mathilda* (of which we gave particulars in our August issue, page 28), built by Messrs. William Gray & Co., Ltd., West Hartlepool, and engined from the Central Marine Engine Works of the builders, to the order of Mr. Jacob Christensen, of Bergen, was taken to sea for her trial trip. On a run to Whitby, and back to Hartlepool, the mean speed was found to be 12 knots, and the performance of ship and machinery entirely satisfactory.

Sergy.—On September 12th the passenger steamer *Sergy*, built in the Ayr yard of the Ailsa Shipbuilding Company, Ltd., of Troon and Ayr, went on her official trial trip on the Firth. The vessel is intended for service in Bahia Bay, and was built to the order of Mr. Japi-Assu for the Government of the State of Bahia, Brazil. Compound diagonal engines have been supplied by Messrs. McKie & Baxter, Govan, and the mean speed attained on the measured mile was fully 10 knots. The *Sergy* is the third of a series of eight steamers placed with the Ailsa Shipbuilding Company, Ltd., for the above service. Messrs. J. M. Campbell & Son, Glasgow, are the acting representatives for the vessel in this country. Mr. D. D. Crookston, London, superintended the vessel during construction.

Asgard.—On September 15th the fine steel screw steamer *Asgard* (of which we gave particulars in our August issue, page 29), built by the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, and engined by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, to the order of Messrs. The Midgard Deutsche Seeverkehrs Aktiengesellschaft, of Bremen, left the Tyne for her trial trip, which was in every way satisfactory, and a speed of 11 knots was easily obtained. Among the guests on board were the following:—Mr. G. Bahr, representing the owners; Mr. J. Graham, representing the builders; and Mr. Russell, representing the engine-builders. After the trial trip the steamer sailed direct for Bremen, under command of Captain Rieck, where she will load for Savannah.

Bendu.—On September 15th the ss. *Bendu*, which has been built at the Wallsend yard of Messrs. Swan, Hunter & Wigham Richardson, Ltd., for Messrs. Elder, Dempster & Co., Liverpool, was taken out to sea for her trial trip. The vessel is of the following leading particulars: Length, over all, 386 ft.; breadth (extreme), 47 ft. 3 in.; and depth (moulded), 30 ft. 8 in. She has been built to Lloyd's highest spar-deck class, with poop, bridge, and forecastle. The officers and engineers are berthed in spacious rooms on the

bridge deck. A complete installation of electric lighting has been fitted, and the vessel has a good equipment of derricks and winches for the rapid discharging of cargo. The deadweight carrying capacity of the vessel is 7,170 tons on a moderate draught of water. The machinery has been constructed by the North Eastern Marine Engineering Company, Ltd., and consists of a set of triple-expansion engines, having cylinders 25½ in., 42 in., and 70 in. by 48-in stroke, steam being supplied by two single-ended boilers, working at 180 lb. pressure, and fitted with Howden's forced draught. On the trial everything worked smoothly, and the vessel attained a mean speed of 11¼ knots on the measured mile.

Cygnus. On September 17th the new steel screw steamer *Cygnus*, built by Messrs. Wood, Skinner & Co., Ltd., Bill Quay-on-Tyne, to the order of Mr. Conrad Blumer Hofgaard, of Christiania, Norway, left the Tyne for her official trial trip. This vessel is of the single-deck type, with short poop, long bridge, and topgallant forecastle. Water ballast is provided in the cellular double bottom, all fore and aft, and in the after peak tank. She is rigged as a two-masted schooner, and fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo. The machinery, which has been constructed by Messrs. The North Eastern Marine Engineering Company, Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple-expansion engines, having cylinders 18½ in., 30 in., 49 in. by 33-in. stroke, steam being supplied by a large steel boiler working at a pressure of 180 lb. per square inch. Notwithstanding the stormy weather, a mean speed of 10 knots was easily maintained on a number of runs over the measured mile, which was considered most satisfactory by all concerned. Amongst those present were Mr. Conrad Blumer Hofgaard, managing owner, Mr. J. Houston, under whose supervision both hull and machinery have been constructed, and Mr. Morvig, of Norwegian Veritas, to which class this vessel has been built, Mr. Skinner and Mr. Leslie Skinner, representing the shipbuilders, and Mr. D. Myles, representing the engine-builders.

Japan.—On September 20th the new steamer *Japan*, which has been built and engined by Messrs. Workman, Clark & Co., Limited, Belfast, for Messrs. Apcar & Co., of Calcutta, left the builders' wharf at Milewater Basin, and steamed down the lough for her speed trials and adjustment of compasses. The *Japan* is the second vessel constructed by the above firm for these owners, and is intended for the mail service between Calcutta and Chinese ports. She is a handsome vessel, 465 ft. in length, with a gross tonnage of over 6,000 tons, and has two complete steel decks, with poop, bridge, and topgallant forecastle, all the exposed decks being sheathed with teak. The cargo space is divided into four spacious holds, each of which has a large hatchway efficiently equipped with steam winches and derricks to ensure rapidity in loading and discharging a general cargo. Special attention has been given to the accommodation for first and second-class passengers. The first-class state-rooms are placed in steel houses on the bridge deck, at the forward and after ends of the engine and boiler casings. These rooms are replete with every convenience for the comfort of their occupiers. The dining-saloon in the forward deckhouse is a handsome apartment, tastefully furnished, and having the pantry situated convenient for service; the lavatory accommodation is also of the most satisfactory character. The bridge deck and boat deck above affords ample promenading space for passengers, the boat deck being approached by stairways amidships and at the after end. The captain's room and chart-room are arranged in a teak house on the flying-bridge deck. State-rooms for the second-class passengers, officers, engineers, and petty officers have been arranged in steel sidehouses below the bridge deck, and are all suitably and comfortably furnished. The engineers' and second-class messrooms are placed in a steel house at the after end of the bridge space on the upper deck. Arrangements have been made for accommodating a large number of native passengers on the main 'tween deck, a native galley and special latrines being provided for their use. The firemen's and seamen's quarters are placed in the forecastle, where a separate galley and lavatory accommodation is provided. An installation of Clayton's fire extinguishing and disinfecting plant has been fitted throughout the vessel. The machinery is of the triple-expansion type, with all the latest improvements, and is supplied with steam from three double-ended and one single-ended multitubular boilers, working under Howden's system of forced draught. The *Japan* has been constructed under Lloyd's special survey for their highest class, and has a Board of Trade passenger certificate. The construction of the vessel throughout has been carried out under the supervision of Mr. Murdo Graham, of Calcutta, Messrs. Apcar & Co.'s representative. After a successful cruise the new steamer proceeded to Barry to take bunker coal and load cargo for her voyage out to Calcutta.

Aysen.—On September 21st the new passenger steamer *Aysen* returned to Princes Dock, Glasgow, after having undergone for two days satisfactory trials on the Firth. The *Aysen*, which is a sister ship to the *Huasco*, completed a few months ago, is about 400 ft. long, and is similar to many previous vessels which Messrs. John Reid & Co., Ltd., Whiteinch, have built for the Companie Sud Americana de Vapores, Valparaiso. The *Aysen* is for the mail, passenger, and cargo service on the west coast of South America, and has all the latest appliances for handling and discharging cargo. Her equipment also includes a very complete installation of electric lighting, also electric fans for the state-rooms, dining-saloon, &c. A Clayton's patent disinfecting machine is fitted, having pipes led to all parts of the vessel, so that any apartment can be disinfected if required. Hall's patent refrigerating plant has also a place on board. The passenger accommodation on the two upper decks extends the whole length of the vessel, and is of the most commodious and comfortable description, consisting of dining-saloon, music-room, smoking-room, and very large state-rooms, as usually found on board this company's vessels, also several suites of rooms, beautifully fitted, having dining-room, bedroom, and bathroom in each. To add to the many appliances on board for the comfort of the passengers, this fine vessel has a complete service of telephones from each state-room to the pantry. The officers and engineers are housed in extra large airy rooms on the after end of promenade deck, and abaft of this there is accommodation for a large number of third-class passengers, while the crew and firemen are berthed in houses on the main deck, which is sheathed with wood, and where not occupied by houses, is fitted up with stalls for horses and cattle. The machinery, which has been supplied by Messrs. Dunsmuir & Jackson, Ltd., Govan, embraces the most up-to-date improvements for economising fuel, and is the sixth set of similar machinery supplied by them to the builders for the company's vessels. Mr. Thomas Dewsbury, of Leeds, representing the owners in this country, superintended the construction of the vessel and her machinery. Captain Selmer, who has been many years in the service, takes command of the *Aysen*.

Tait's Memory Work for Board of Trade Examination of Mates and Masters. Glasgow: James Munro & Co.

The author says he has compiled this little work with a view of assisting mates and masters who are studying for Board of Trade certificates. He has introduced other useful matter required in these examinations. We find the subject treated in the way of questions and answers, and commenced with spherical trigonometry, the basis of the sailor's problems, connected with the calculations to find a ship's position at sea. Diagrams, as a rule, illustrate each question, which makes the matter in each case clear and precise. Considerable ingenuity is displayed in the setting these questions, showing how searching these examinations may be. Sailors know well, for instance, what the equation of time means; but here we find it set out graphically, so that there is no mistaking the matter by the simplest understanding. The same with other definitions, such as refraction, parallax, leeway dip of the horizon, hour angle, sidereal time, and all the structure on which a seaman's general knowledge rests.

Following these simple definitions, we enter upon more complex matters, like adjustments of the sextant, the system of which is still question and answer. Next we find the law of storms treated, and here an officer would require to use his practical knowledge somewhat fully, as cyclones are naturally a great trouble to be dealt with, and many difficult queries can be put. Deviation of the compass heads another section, which is made a somewhat lengthy and close one, a question being, for instance, as to what transient induced magnetism is. Where special explanations are necessary, we find them also, with a copy of the new regulations for preventing collisions at sea, steering and sailing rules, notes on practical navigation, and general information required by officers. We should say this little book would be likely to be most valuable, for those for whom it is intended, in enabling them to steer through the pitfalls these examinations afford.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from August 23rd to September 21st, 1906:—

Engineer-Captain.—C. J. North, to the *Barfleur*, additional, on the staff of Rear-Admiral Commanding Reserve Division, Portsmouth, to date September 20th.

Engineer-Commanders.—J. W. Agnew, to the *Vivid*, for the *Hannibal*, to date September 4th; J. G. Baker, to the *Aboukir*; C. W. Bolt, to the *Sirius*, on arrival at St. Helena, undated; C. Broadbent, to the *Challenger*; W. D. Chope, to the *Hyacinth*, to date September 7th; T. W. Christian, to the *Barfleur*, additional, to assist the engineer-captain as regards shipbuilding by contractors and for taking records of trials, to date September 20th; F. M. Cottam, to the *Talbot*, on recommissioning, to date September 11th; J. S. Gibson-Sugars, to the *Prince of Wales*, to date August 27th; W. T. Hocken, to the *Vivid*, to assist in supervision of machinery of torpedo boats and torpedo-boat destroyers, to date August 30th; F. Hore, to the *Majestic*, on recommissioning, to date October 2nd; H. Humphreys, to the *Pembroke*, for the *Inflexible*, and to assist on the staff of Admiral-Superintendent of District, to date September 3rd; F. G. Jacobs, to the *Barfleur*, on recommissioning; C. G. Knight, to the *President*, as engineers' overseer at Messrs. Brown & Co.'s Works, Clydebank, to date September 1st; T. C. Morris, to the *Vivid*, for the *Hebe*, to date August 28th; W. H. S. Moysey, to the *Speedwell*, on commissioning, to date September 4th; G. W. Murray, to the *Donegal*; J. H. Pill, to the *Excellent*, for the *Revenge*, on recommissioning, to date September 8th; A. R. Rolle, to the *Europa*, to date August 22nd; V. E. Snook, to the *Sappho*, on recommissioning, to date September 1st; E. F. Sparks, to the *Formidable*, on recommissioning, to date October 2nd; J. G. Stevens, to the *Egmont*, additional, for torpedo store, to date August 22nd; E. J. Taylor, to the *Jason*, to date September 12th; E. C. Thornhill has been placed on the retired list, to date September 1st; W. F. Turner, to the *Vernon and Excellent*, for torpedo and hydraulic courses, to date September 15th.

Engineer-Lieutenants.—F. Alexander, to the *Vernon and Excellent*, for torpedo and hydraulic course (lent), to date September 15th; H. O. Andrews, to the *Sapphire*, for the *Mermaid*, to date September 11th; A. G. Barker (acting), to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; R. J. Block, to the *President*, temporary, to assist the resident engineer-overseer at Messrs. Parsons, to date September 15th; W. Briggs, to the *Prince of Wales*, to date September 10th; J. G. Budge has been antedated in seniority from April 1st, 1906, to July 1st, 1905; F. A. Butler, to the *Minerva*, on recommissioning; C. A. Codrington, to the *Victory*, for the *Cochrane*, to date August 22nd; E. G. Connors, to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; W. J. Dixon, to the *Barfleur*, on recommissioning; A. H. A. Dowman, to the *Exmouth*, to assist Engineer-Captain; P. G. Drake, to the *Hecla*, for the *Waveney*; W. G. Glanville, to the *Leda*, on recommissioning, to date September 4th; H. H. Gordon, to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; C. A. Harding, to the *Diamond*, to date September 7th; R. A. Howley, to the *Formidable*, on recommissioning, to date October 2nd; T. P. Jackson, to the *Hussar*; R. S. Jennings, to the *Minerva*, on recommissioning, to date September 11th; B. J. C. Johns, to the *Prince of Wales*, on completing, to date September 8th; H. H. Johnson, to the *Formidable*, on recommissioning, to date October 2nd; C. J. Limpenny, to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; H. J. Little, to the *Sapphire*, for the *Kale*, to date October 1st; P. C. Minhinnick, to the *Blake*, for the *Greyhound*; E. E. Moore, for the *Sapphire*, to date September 11th; C. E. H. Osbourne, to the *Vernon and Excellent*, for torpedo and hydraulic courses, to date September 15th; A. E. E. Rayner, to the *Pelorus*, on recommissioning, undated; S. Rider, to the *Vivid*, for Devonport yard, as first assistant to the manager engineering department; S. G. Roch, to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; A. G. G. Rosevere has been antedated in seniority from April 1st, 1906, to July 1st, 1905; F. J. Roskruge, to the *Exmouth*, to date August 27th; A. F. Sawyer, to the *Barfleur*, additional, for service with Engineer-Captain, to date September 20th; J. F. Shaw, to the *Britannia*, on completing, to date October 2nd; E. C. Smith, to the *Leander*, for the *Orwell*, undated; H. P. Sparks, to the *Scylla*, on recommissioning, to date September 1st; R. Spence, to the *Sapphire*, for the *Panther*; C. E. Stone, to the *Excellent*, for the *Revenge*, to date September 8th; A. E. Straw, to the *Vivid*, to be detailed for the *Aquarius*, to date September 12th; H. B. Tostevin has been antedated in seniority from April 1st, 1906, to October 1st, 1904; H. B. Tostevin, to the *Britannia*, on completing, to date October 2nd; E. V. Waud, to the *Majestic*, on recommissioning; E. J. Weeks, to the *Pelorus*, on recommissioning, undated; W. A. Wilson, to the *Vernon*, for the *Niger*, to date August 28th.

Engineer-Lieutenant (Acting).—A. G. Barker has been confirmed in the rank of engineer-lieutenant.

Engineer Sub-Lieutenants.—M. E. T. Baker has been promoted to the rank of engineer-lieutenant, with seniority of August 1st; R. C. Beddie*; B. C. Bowles has been promoted to the rank of engineer-lieutenant, with seniority of September 1st; W. Briggs has been promoted to the rank of engineer-lieutenant, with seniority of August 1st; F. G. Brown*, G. W. Cannan*, T. R. Cave-Brown Cave*; B. Child, to the *Vernon and Excellent*, for torpedo and hydraulic courses, to date September 15th; S. C. Church*; G. F. Croker, to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; A. G. Crousaz*, S. R. Dight*, V. O. Foreman*; D. Hill, to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; W. H. F. Hudson*; A. G. Jarrett, to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; H. Leather, to the *Vernon* and *Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; L. J. Le Mesurier*, W. W. Lock*, R. Montgomery*, V. D. Nops; G. W. Odam, to the *Sirius*, for passage out and home, to date September 18th; W. F. Paffett*, H. H. Perring*, J. W. Phillips (acting)*, E. McK. Phillips*, G. Preece*, C. H. J. Purkis*; G. Robins, to the *Formidable*, on recommissioning, to date October 2nd; H. A. Sheridan, to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; W. Smith has been promoted to the rank of engineer-lieutenant, with seniority of September 1st and re-appointed to the *Vivid* on promotion; W. Smith, to the *Vernon and Excellent*, for torpedo and hydraulic courses (lent), to date September 15th; L. Thackara*, P. W. Warwick*, S. G. Wheeler*, E. Williamson*, A. C. Wippell*; A. S. Wise has been promoted to the rank of engineer-lieutenant, with seniority of September 1st.

Chief Artificer Engineers.—E. Dewey, to the *Leda*, on recommissioning; W. H. Edwards, to the *Vivid*, to be detailed for the *Moth*, and to assist on the staff of the Admiral Superintendent, Tyne and Southern District, to date September 12th; L. Self, to the *Merlin*, on commissioning, to date September 4th.

Artificer Engineers.—A. Baldwin, to the *Prince of Wales*, on completing, to date September 8th; J. Bronkhurst, to the *Ganges*, for Shotley Barracks, for mechanical training of boys; W. S. L. Collins, to the *Vivid*, for Torpedo-boat 108, to date September 11th; E. H. Ferguson, to the *Triumph*, to date August 27th; J. Kirkham, to the *Talbot*, on recommissioning; E. F. Smith, to the *Britannia*, on completing, to date October 2nd; R. H. Wood, to the *Minerva*; J. Wright, to the *Majestic*, on recommissioning.

Royal Naval Reserve.

Senior Engineers.—W. H. Stanley has been placed on the retired list.

Assistant Engineer.—J. C. Craig, to be engineer.

* To be lent to Royal Naval College, Greenwich, for course of study, to date October 1st.

BOARD OF TRADE EXAMINATIONS.

Note.—1C denotes First Class; 2C Second Class.

August 25th, 1906.

Adams, A. G.	2C	Liverpool
Allan, David D.	2C	Glasgow
Barclay, Robert	2C	Glasgow
Berry, Clement	1C	London
Beynon, Thomas	2C	Cardiff
Bowlerwell, W.	1C	N. Shields
Buglass, William	1C	N. Shields
Campbell, A. D.	2C	Glasgow
Coulton, John H.	1C	W. Hart'l
Davis, Henry J.	2C	Cardiff
Del Rio, Philip	1C	Glasgow
Dickinson, A. W.	1C	W. Hart'l
Forster, H. C.	2C	W. Hart'l
Fortune, A. G.	1C	Leith
Gay, David H.	1C	N. Shields
Gebbie, Hugh	1C	Glasgow
Good, Reginald	2C	Cardiff
Gray, Thomas	2C	W. Hart'l
Gunn, George	2C	Glasgow
Haig, John E.	2C	Glasgow
Haley, Herbert J.	1C	Cardiff
Heggum, E. E.	1C	Liverpool
Henderson, J. M.	1C	Leith
Hill, Godfrey H.	2C	Glasgow
Jasper, Alfred	2C	Cardiff
Klitz, Hubert H.	2C	South'ton
Lewthwaite, J.	2C	Cardiff
Madge, Percy	2C	Cardiff
Mason, William.	2C	W. Hart'l
M'Curtain, H. R.	1C	Liverpool
Merweather, S. P.	2C	N. Shields
M'Kenzie, D. J.	1C	Glasgow
M'Lelland, T.	1C	Glasgow
Neil, Robert	1C	Glasgow
Neilson, William	1C	Glasgow
Oakes, Arnold	1C	W. Hart'l
Parry, Thomas	2C	Cardiff
Pickles, G. A.	2C	W. Hart'l
Pool, Thomas	1C	Cardiff
Pounder, Alfred	2C	W. Hart'l
Poutous, A. G.	2C	Cardiff
Rutledge, G. R.	2C	London
Sharp, Archibald	1C	Glasgow
Smith, W. R.	1C	London
Stamp, Frank	2C	Glasgow
Stewart, Duncan	2C	Glasgow
Thomas, David J.	2C	Cardiff
Thomas, Richard	2C	South'ton
Thomas, W. O.	2C	South'ton
Thomson, R. G.	1C	Glasgow
Turner, F. E.	2C	Cardiff
Varian, A. H.	2C	Liverpool
Wilkin, Robert	1C	N. Shields
Williams, D. K.	2C	Liverpool
Williams, F. B.	2C	Cardiff
Wilson, Harry	1C	W. Hart'l
Wilson, John	1C	Glasgow
Young, George	2C	Cardiff

September 1st.

Abbott, Edward.	1C	N. Shields
Beaton, H. A. F. L.	1C	Aberdeen
Bingham, Thomas	1C	Liverpool
Blair, Matthew	1C	London
Bolton, Harry C.	1C	Sunderl'd
Brackenbury, A.	2C	Hull
Brophy, Andrew	1C	Liverpool
Cleaver, George	1C	London
Cooke, Henry	1C	Sunderl'd
Coombe, John	2C	London
Cordingley, John	1C	Liverpool
Dickie, James G.	1C	N. Shields
Gold, Robert	2C	Greenock
Gordon, John T.	2C	Greenock
Groom, W. H.	1C	Liverpool
Haswell, T. P.	1C	Sunderl'd
Hynd, John	2C	London
Johnson, W. H.	1C	Sunderl'd
Johnson, Frank	1C	Hull
Jones, William	1C	Sunderl'd
Lawson, Charles	1C	Liverpool
Lawson, John W.	1C	N. Shields
Logan, W. G.	1C	Greenock
MacLeod, C.	2C	Greenock
Martin, John S.	1C	Sunderl'd
Maybank, Alfred	2C	London
Murray, W. L.	2C	London
Naismith, R. F.	2C	Greenock
Newcastle, H. F.	2C	N. Shields
Oldershaw, R.	1C	Liverpool
Owen, Richard	2C	Liverpool
Parkinson, R.	2C	Sunderl'd
Pearce, W. C.	2C	Greenock
Pearson, T. A.	2C	N. Shields
Robson, E. G.	1C	London
Rogers, A.	1C	Aberdeen
Spark, George	1C	Sunderl'd
Stirling, Robert	2C	Greenock
Unwin, F.	1C	London
Wanlass, Joseph	2C	Sunderl'd
Winter, E. W.	1C	London
Young, Charles	2C	N. Shields

September 8th.

Bankes, Harry T.	1C	Liverpool
Blackmore, I.	2C	Cardiff
Bridson, W. J.	1C	Liverpool
Butler, John	2C	Leith
Campbell, D. P.	2C	Belfast
Cross, A. U.	2C	Glasgow
Davis, Lewis C.	2C	London
Ferguson, H. J.	2C	Glasgow
Gillies, C. M'G.	2C	Glasgow
Godkin, Arthur	1C	Liverpool
Hadden, George	2C	Glasgow
Harris, Thomas	1C	Cardiff
Holmes, Arthur	1C	Glasgow
Houston, J. A. E. W.	1C	Cardiff
Hughes, W. A.	2C	Belfast
Hull, George	1C	London
Jardine, John	2C	Glasgow
Jones, William	1C	Glasgow
Makey, Harold	2C	London
M'Auley, Thomas	2C	Belfast
M'Clafferty, E. F.	1C	Glasgow
M'Cullock, David	2C	Glasgow
M'Kenzie, W. J.	2C	Glasgow
M'Laren, W.	1C	Glasgow
M'Master, T. W.	2C	Glasgow
Ramsey, A. R.	2C	Glasgow
Shaw, William T.	1C	Glasgow
Shimmin, T. S.	2C	Liverpool
Sloane, Robert S.	1C	Glasgow
Smart, David	2C	N. Shields
Sutherland, W. M.	1C	Glasgow
Taylor, John	1C	Glasgow
Vint, Peter	1C	Glasgow
Ward, John	1C	Glasgow
Wilkinson, R. G.	2C	Liverpool
Williams, T. D.	2C	Cardiff
Williamson, J. M.	1C	Glasgow
Woodfield, David	2C	Cardiff

September 15th.

Anderson, T.	2C	Dundee
Barrow, J. R.	1C	N. Shields
Bode, F. J.	1C	London
Browell, Thomas	1C	N. Shields
Connell, John J.	2C	Liverpool
Crosley, Guy	2C	Hull
Davidson, A.	2C	Greenock
Elton, Ernest F.	1C	London
Eves, Henry E.	2C	London
Fitch, J. R. M.	1C	London
Francis, F. A.	1C	London
Grimmett, A. J.	1C	London
Hall, Alfred	2C	Hull
Hutchison, C. R.	2C	Dundee
Johnson, H. A.	1C	Hull
Marley, A. S.	2C	N. Shields
Matthew, G. A.	2C	Dundee
McBain, John K.	1C	Dundee
McIntosh, James	1C	London
McNeil, David	1C	Dundee
Middlemiss, F.	2C	Hull
Reader, S. J.	2C	N. Shields
Roberts, Arthur	2C	London
Scotland, W. D.	2C	Greenock
Skipper, C. N.	2C	London
Swede, T. M.	2C	London
Watson, James S.	1C	Dundee

REVIEW.

Indicator Diagrams for Marine Engineers. By W. C. McGibbon. Glasgow: J. Munro & Co. 1906.

Though much has been written on indicator diagrams from time to time and it would be thought the subject was well night exhausted, yet, with this book before us, which is intended for marine engineers solely we can say it is one that meets a want. Set going marine engineers must do the best for their owners and it is only in the main they can do this by correctly taking diagrams. They have their ordinary duties to attend to in the way of current repairs and adjustments; but it is on the engine side, they are to work economically it can only be by a study of what goes on in the cylinders. Though examinations at very searching character, yet none of them venture too deeply in this branch. Questions set are comparatively simple and it is therefore left for engineers at sea to do the best they can for themselves in this particular. With this book as an assistant we however, trust to their difficulties will much be lessened. The author commences from the beginning, and shows us the origin of the indicator. We see that a good deal took place before the present day specimens of the instrument was possible; and in this with which we are familiar. Any one who is acquainted with the parallel motions connected therewith. Sections are found of several well known types of instrument, taking the construction in detail.

Turning to the diagram the various principles are clearly enunciated with a thorough explanation of the cut off and lead mean. Then there is the question of area, taking a diagram to be considered with reference to different classes of engines. Then we have direction of diagrams to be found, with a number of cards suggested, and the suggested. Next we have the measuring a diagram after it is taken and here we see there is more than one way of doing this. The law of Boyle relating to pressure and volume is briefly discussed and expansion curves both theoretical and practical the endeavour being to make the matter as simple as possible. The combining of cards of the high intermediate and low pressure cylinders is thoroughly explained, and the effect produced by the setting of cranks in multi cylinder engines. The comparison between the indicator card and a Zeuner valve diagram is well illustrated, and what is very often a somewhat abstruse matter in literature of this subject is here simply put forward. With reference to finding the H.P. it is shown how to calculate the mean effective pressure by several rules, where cards cannot be taken, and also how to get at the weight of steam from the card. The balancing of an engine which is an important matter, is fully described, by means of the diagrams, with the steps to be taken to remedy inequalities in the cylinders. The reason for the loops that are frequently found at the corners of diagrams are mentioned, and we find also the cards that have been taken from the auxiliaries, such as steering engine, pumps of various kinds, refrigerating engines, and Joy's assistant cylinder. There is a chapter, too, on defective diagrams generally, with remarks thereon in each case, and, under the heading, "Miscellaneous," we find cards having special reference to peculiar questions very often set by examiners, the work finishing with tables, which are necessary in steam calculations. When we say there are nearly 200 illustrations it may be gathered that the author has done all that it is possible to do to make his subject clear, and we can only say we do not remember to have had anything before us previously on this interesting detail of an engineer's curriculum that compares with the present effort, and that it is likely to be appreciated accordingly.

The Marine Engineer

And Naval Architect.

LONDON, NOVEMBER 1, 1906.

THE attention of shipbuilders and ships' officers may be very usefully turned to the paper read before the Institute of Marine Engineers, at the end of September, on the important question of sanitation at sea. Mr. A. E. Battle, the author of the paper in question, deals with his subject under the main heads of ventilation, water, and sanitary appliances, and no doubt it might be thought by those who have never considered the matter, that, amid the fresh breezes of the ocean, with the wide seas which can receive and purify all foul substances, surrounding the ships, there should be little difficulty in making vessels at once sanitary and pleasant. But we know that the ships of former times were remarkably unsanitary even in unsanitary ages, and Mr. Battle reminds us that in certain classes of vessels to-day the prevailing conditions are by no means equal to those which have been reached in shore buildings. The reasons of this state of things are sufficiently obvious. The construction of a ship, built to keep out the water, is such that it is impossible to thoroughly ventilate her hull by natural means, whilst the numbers of people which she carries are far in excess of those which would be found within similar limits ashore. As regards the sanitary appliances, the difficulties of limited space are accentuated by the fact that the action, gravity—which is so largely relied on ashore as a means for disposing of sewage matter—is hampered by the unstable motion of the vessel as a whole. Mr. Battle's paper is valuable because it summarises many of the facts connected with the subject with which he deals, and shows many of the mistakes which are made in the design and management of ships' appliances. It is well for ships' officers to be reminded, for example, of the danger of pollution of the water supply if the sounding plugs of the tanks are allowed to be fouled when the decks are in process of cleansing. Another important point in this connection was brought forward when the author showed how liquid pollution can be drawn into a leaky pipe, even when its contents are kept moving under pressure. On shipboard, owing to the limits of space, there is always a danger that pure air or water may pass through contaminated surroundings, and thus, instead of being a source of health, may become a vehicle of disease. These points have, in the first instance, to be borne in mind by those who design the vessels. For they have to remember not only that their scheme must be such that the appliances shall work well when in order, but that when damaged or working under unfavourable conditions they shall not be capable of causing trouble to their surroundings. Mr. Battle gave an instance where the soil-pipe of a closet passed through the lazarette where open packages of provisions, including butter and cheese, were kept. The pipe was choked by the passage into it of a cloth, and in clearing it a hole was made. This was patched as well as it could be done under the circumstances, but it was not gas-tight, and the story is best left without further elaboration.

The paper is calculated to be of considerable value, because it suggests so much that is desirable in principle, and points out so many usual faults in application, whilst it also gives hints to ships' officers as to the proper care and maintenance of the appliances with which they are charged. It must indeed be remembered that the more delicate the design the more likely there is to be trouble, if care in use be not insisted on. Appliances for use on shipboard are used by rough and careless persons, under conditions which are by no means favourable to watching. There is therefore need of simplicity in design and strength in execution on the part of those who equip the vessel. But much may be done to insure cleanliness and efficiency by the care and influence which the ships' officers can use and extend to those under them. The study of such a paper as Mr. Battle's is likely to stimulate those who can improve the condition of sanitation on ship board. This is the proper method of inducing such reforms. It is both effective and permanent. We should certainly deprecate any extension by a new Merchant Shipping Act of the obligations upon the shipowner in the way of an increase of regulations in respect of sanitary matters. Legislature is a costly and burdensome method of procedure, and it is one which, in these days of foreign competition, becomes absolutely oppressive. Increase of cost in construction and working of steamships handicaps the shipowner in the international competition, and so tends not only to deprive him of profit, but also to lessen the number of berths which are open to those who man and officer our ships. Mr. Battle rather hints at further legislation, and for the reason we give we deprecate the suggestion, but for the rest of the paper we have nothing but praise.

It will be remembered that we have given some publication to the attempt to apply a gas engine or engines with a producer gas distillation plant in place of boilers as a strongly recommended means for the driving of steamers. We therefore think it well to notice here a paper read by K. Reinhardt before the Iron and Steel Institute upon the applications of large gas engines in the German iron and steel industries as serving to show that such large engines of over one thousand horse-power are doing well in Germany and obtaining other engines for them. It is only about ten years ago that England, Germany and Belgium, woke up to the fact that blast furnace gases might be burned directly in gas engines, instead of being burnt under steam boilers, and with good economy. This experiment was begun with small engines which gave beneficial results, and when it

was shown, that poor blast furnaces gases, in spite of defective scrubbing, could with safety be transformed into mechanical work in a gas engine, a considerable demand for gas engines of over a 1000 H.P. each was met and had to be supplied. In 1898 a 600 H.P. gas engine with two cycles was made in Germany by the Berlin-Anhaltische Maschinenbau Gesellschaft, of Dessau, and this gas engine is still working satisfactorily. The improvements of engineers in their designs and in the valves constructed for these gas engines were shown in the Deutz double-acting four cycle motor. A large series of questions were compiled for answer by the iron works and collieries of Germany, to which a series of answers were received in March of this year from the German iron works and collieries to which he had addressed them. To these replies were given as to 203 engines being already at work in these iron works and collieries, and 146 engines were in course of erection and on order. Altogether these represented a horse power of 385,000, of which some 64 were of an old make representing about 500 H.P., and the balance represents over 1,000 H.P. per engine. The largest aggregate power of gas engines at a single works amounts to 35,000 effective H.P. Sixteen works possess over 10,000 H.P., and 27 works possess over 5,000 H.P. in actual working. The cleaning of the gas for working in gas engines has proved of some trouble to these users, as all the German gas-engine makers have considered this necessary; only the Cockerill Company have completed an engine which they claim will use impurified gas. The design of this gas engine was only about 600 H.P. in a single acting cylinder, and was made of large dimensions, and parts likely to be injured by the dust were not present. The rest of the paper is filled with special details of the gas justification and the particular designs of large gas engines for the purpose. We must refer those interested to the paper.

Messrs. A. G. Mumford, Ltd.—We have recently received a copy of a new illustrated catalogue issued by Messrs. A. G. Mumford, Ltd., of Culver-street Engineering Works, Colchester. This catalogue, which comprises nearly 150 pages of illustrations and descriptions, is printed on art paper, which gives the publication a very superior appearance. The catalogue is divided into four sections, which may be summarised as follows: Section A. illustrates and describes fully their standard patterns and sizes of compound condensing marine engines; launch machinery; auxiliary engines; air and circulating pumps; and surface condensers. Section B.: Steam boilers, including full particulars of the "Mumford" patent water-tube boiler. Section C.: Steam launches; Admiralty cutters, and pinnaces; stern-wheel steamboats; yacht and tug machinery. Section D. covers full particulars of their specialities in flywheel, duplex, simplex, and other types of steam pumps, as supplied to the British Admiralty, foreign Governments, and mercantile marine. The "Mumford" patent water-tube boiler referred to in Section B. is illustrated and described in a comprehensive manner, and special reference is made to the particular method adopted by this firm in setting out the tubes in the tube-plate.

THE SCREW PROPELLER.

IV.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., &c.

MR. GRIFFITHS took out his first patent in 1849, and continued to invent and take out further patents either by himself or in connection with other inventors as late as 1876; but, although these are numerous, only a few of them are now of interest; two of them, however, are of special interest to-day inasmuch as the proposals contained in them have been recognised as correct and carried into practical effect. In patent No. 2976, taken out in 1860, he states that "screw propellers of smaller diameter than those heretofore used may be employed without increasing the propelling effect," many years, however, were to elapse before this important statement was accepted as correct and acted upon in practice; and, although, as will be seen later on, experiments were made with propellers of smaller diameter as against the larger ones, the latter continued for some time to be used in the Navy, and, for a much

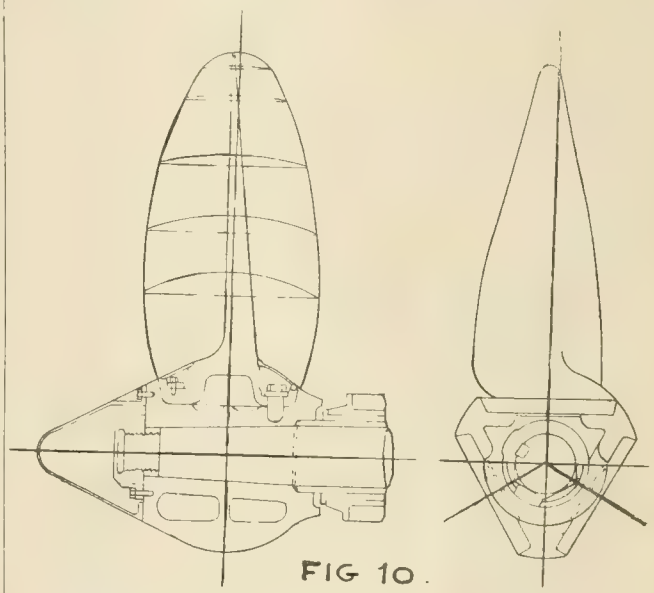


FIG 10.

ROBERT'S SCREW BOSS 1851.

longer period, in the mercantile marine; in fact, even to-day, as a rule, propellers are larger in diameter than necessity requires.

The other interesting proposal of Mr. Griffiths is contained in patent No. 3817, of 1873, and is as follows: "The tunnel for a stern propeller is made with a 'lip, scoop, or projection,' extending down from the after side of the mouth of the tunnel. The projecting piece may be hinged, so that it can be raised up when not required, as in the case of vessels driven by screws both at the bows and stern, in which case it is stated that the additional speed given by the bow propeller ensures a sufficient supply of water to the propeller at the stern. Similar arrangements may be made when twin screws are employed. The outlet end of the stern tunnels may be widened to allow the water to escape freely. This idea has been perfected and carried out to a successful issue by the enterprise of Mr. Yarrow.

Richard Roberts, now to us only a name, was the inventor of that addition to Griffiths's spherical boss, which enhanced the efficiency of propellers largely; in fact, it may be said to have completed the value of the spherical boss, by adding what was wanting in Griffiths's inven-

* For articles 1, 2, and 3, see August, September, and October issues.

tion. Roberts, in 1851, or two years after Griffiths's first patent, took out patent No. 13779, in which he claims the following: The improvements consist "in making the boss of screw propellers much larger than usual, in order that the vanes may act more effectively on the water, and in extending the bosses backwards far enough to admit of their being tapered, or otherwise formed so as to allow the water to close upon them without a counter current being produced." The diameter of the boss is at least one-third that of the 'propeller wheel,' and the width of the arms about one-sixth the diameter of the propeller. The end of the boss astern of the propeller comes to a curved, conical point, and forward of the propeller it is "softened into the body of the vessel." In point of fact, the propeller boss, as proposed by Roberts (Fig. 10) is of the exact form now found in every-day practice in his Majesty's Navy, and in all steamers where high efficiency is necessary.

Although four-bladed propellers had been proposed, and had been used, in the mercantile marine between 1850 and 1860, the two-bladed propeller continued in general use in the Navy, chiefly because of naval ships continuing to be fully rigged, and expected to be, and were, navigated under sail as often as possible. For this same reason, the first four-bladed propellers used in his Majesty's service were those known as the "Mangin," and consisted of two-bladed propellers, placed one in front of the other; and, as these blades were comparatively narrow ones, it will be seen that when placed in a vertical position they formed a less obstruction to the water than the common screw or the Griffiths.

Fig. 11 is an illustration of such a screw as was in common use in her Majesty's Navy from 1860 to about 1875. As these screws were often made in two parts, it is easily seen, by having a second key-way in one part, it might be moved so that its blades were at right angles to those on the other part, and thus it became practically an ordinary four-bladed screw. As a general rule, however, they were kept with the blades parallel, and thus they worked with a fair amount of efficiency, especially when compared with the common screw, no doubt due to the fact of the blade surface at the tip being reduced, as in the Griffiths, although not to the same extent.

In 1871, a new propeller genius appeared on the scene, named Herman Hirsch. The first patent taken out by this gentleman was in 1859, and in 1860 he took out patent No. 2930, in which he claims certain improvements in the screw propellers, as follows: "The improvements apply to the form of the blades of propellers for vessels, the surfaces of which are made of such a curvature that, if sections were made by cylindrical surfaces concentric with the axis of the propeller, the profiles of the sections on these cylindrical surfaces would show a pitch gradually increasing from the entering edge in such a manner that every successive portion of the surface, reckoned from the entering edge, gives the water an additional impulse backwards as it revolves through it, and, if sections were made by planes perpendicular to the axis of the propeller, the profiles of the surfaces on these planes would be spiral lines, concave towards the water, acted on in such a manner that every portion of the surface, in revolving through the water, impels it to some extent towards the axis, and thus overcomes a portion of its centrifugal tendency. That surface of the blade which acts on the water is, therefore, made of such a curvature as to combine the two curvatures above described, namely, the curvature of increasing pitch, as projected on cylindrical sections, and the spiral curvature, as projected on planes perpendicular to the axis." In 1871, he took out another patent, No. 2257, making claim to a further set of improvements in the form of the blades. For some few years, Mr. Hirsch's name was before the public as a gentleman whose propeller had made almost miraculous differences in the speed of ships; and it is quite true that in very many instances most marked improvements were made in the speed of the ships so fitted, and, when the speed was not materially improved, it was found that there was a saving in I.H.P. If Mr. Hirsch had been clever enough to let severely alone certain ships whose performance was already satisfactory, he might have continued for a much longer time to be patronised by all those who were disappointed in the speed of their ships, or who were anxious to get, at any cost, a higher speed. As a matter of fact, the success of the Hirsch propeller was due chiefly to the fact that it was designed, as regards diameter, pitch, and surface, much more nearly to the true requirements than was common with engineers in that day, and in the cases where his success was so very great, the ships had been originally fitted with propellers of very bad proportion, and quite unsuited to their form.

The four-bladed propeller came into general use in the mercantile marine in the early 'fifties, and although three-bladed screws were not uncommon in smaller vessels, and even the two-bladed ones were to be found, the great majority of merchant ships had in 1868 solid cast-iron four-bladed screws, the blades of which all

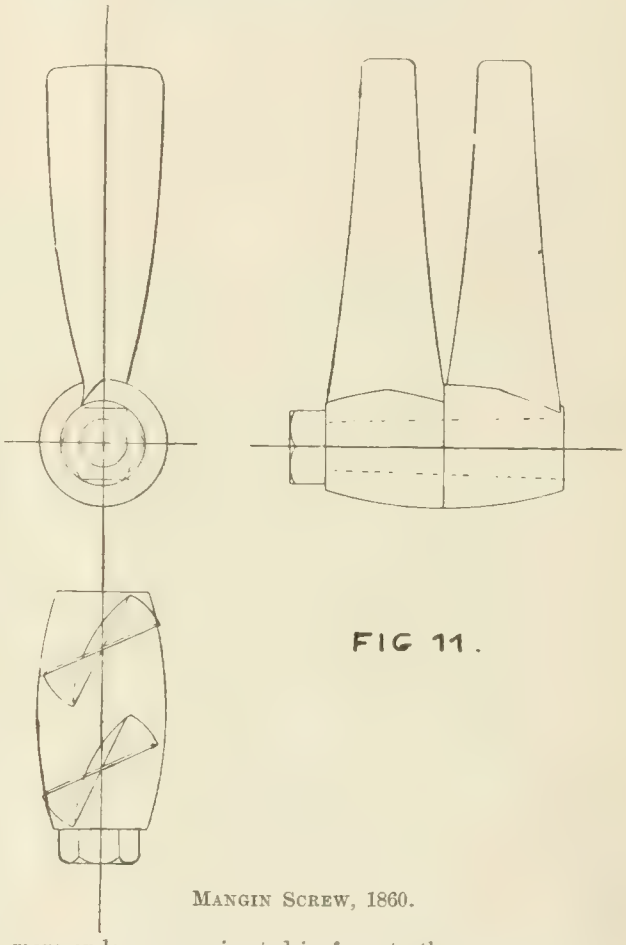


FIG 11.

Mangin Screw, 1860.

more or less approximated in form to the common screw, with both its corners cut away. The diameter was generally much larger in proportion to the I.H.P. per revolution than is common to-day. The broadest part of the blade was on an average 1-5th the diameter, and it was situated at about 1-5th the diameter from the tip. The breadth at the tip was about $\frac{1}{8}$th the diameter, and at the boss about 1-6th.

About twenty years ago the demand for a higher speed of ship set in, consequent on the introduction of the triple-expansion engine, with its decreased consumption of fuel, necessitating alterations in the proportions of the screw, the maximum breadth being increased to 0·225 of the diameter, and, later on, with a further increase of power, to 0·235, at which it remains to-day. The ratio of bladed area to disc area was formerly 0·33, to-day it is 0·43, on the average; with large Atlantic steamers, the surface is about 0·38, and the small river and coasting steamers 0·53.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

The Canadian - Pacific Railway's

NEW steamers are now fulfilling the boast which their owners have always made of them, viz., that they are the largest and *fastest* steamships in the Canadian trade. They were expressly designed to beat the Allan turbine-engined boats, and they have now accomplished that which Fairfield undertook to do, and which everyone expected such a firm to carry out. The *Empress of Ireland*, leaving Rimouski at 9 a.m., on October 6th, reached the Mersey Bar at 6 a.m. on the 12th, thus completing her voyage, allowing for difference of time, in five days, sixteen hours—a very fine performance.

The Port of Zeebrugge,

which the Lancashire and Yorkshire Railway has made the terminus of its new Continental passenger line, has been aspersed by a correspondent in the "Nouveau Precurseur," an Antwerp newspaper. The writer asserts that the entrance to the harbour cannot be made of such a depth as its supporters wished, whilst it is also alleged that the present depth is maintained with great difficulty and at considerable expense. The harbour managers are naturally indignant at these suggestions and state that there is no truth in them. Moreover, in reply to a further suggestion that the port was doing little trade, they also point to the satisfactory returns which have been made. In the month of August some fifty-five steamships, of a total tonnage of 30,942 tons, visited the port, whilst the British Consul-General at Antwerp has reported officially that, though all the Belgian ports show a satisfactory increase for the first six months of the year 1906, the augmentation in respect of Bruges and Zeebrugge is particularly noticeable.

The Thames Steamboats.

The end of the season fixed by the London County Council having been reached, the municipal fleet is now laid up for the winter. This fact was mentioned at the meeting of the Council on October 16th, and the failure of the steamboats admitted by Sir. John Macdougall, chairman of the Rivers Committee. He could, indeed, hardly do otherwise; but he went on to make the astounding remark that "he would even go so far as to advocate running the service free, if the people would only use it." Here we have a fine instance of municipal working run mad. The Thames above London Bridge as a highway is played out. Faster and more convenient modes of travelling are provided on the banks, and the old private-owned steamboats found that their occupation was gone. They were accordingly—having business men concerned in their management—taken off the station. No attempt was made by private enterprise to fill up the void thus created, every one in the commercial world realising the true situation. But the lesson of the stoppage was not recognised by the members of the London County Council, or else they burned to have a fleet and become shipowners of sorts at any cost to the unhappy ratepayer. All kinds of reasons, except the correct one, were put forward to account for the failure of the old company, and a brand new fleet was ordered. How costly it was and how great has been the failure everyone to-day knows. Yet even now the lesson has not been taken to heart. The innuendo is made that, if it were not for the fares, people would still travel by the vessels. This may be true. For there are idle people who like an occupation which entails no labour, and there are poverty-stricken wretches who would be glad of the shelter which the cabins of the boats afford. But other means are provided for housing the poor, whilst it has hardly as yet been reckoned as the function of the ratepayers to provide excursion steamers for the public, though it is evident that the minds of some of the Councillors lean towards providing municipal entertainments. The matter is a very serious one for London ratepayers, and the remark of Sir John Macdougall should be borne in mind.

Wireless Telegraphy.

The great liners on the Atlantic make so much use of their wireless installations that all marine engineers will be interested in the proposals of the Berlin Conference to regulate the use of this method of communication. What exactly the outcome of the conference may be is not yet seen. But it has been hinted that the German Government has some desire to improve the position of the Slaby Arco system, which the Germans more particularly affect, as against the Marconi Company, who have entered into arrangements with the steamship companies and Lloyd's for providing and working the installations on so many British ships and at so many British land stations. Incidentally a strong sidelight has been thrown on the genesis of the invention. We are so accustomed now to hear that the big liners have never lost touch with the shore during the whole of their passage, and to see copies of the journals which are published in mid-ocean, that we are apt to forget how recent the invention is. But nine years ago experiments were being conducted and communication maintained over but few miles of sea, whilst no one seemed to have quite realised the possibilities of the invention. Even Signor Marconi himself failed to grasp the full scientific meaning of his own discovery, and did not, at first, realise that he was using Hertzian waves as his medium of communication. There seems, too, to be a very pretty quarrel amongst scientific men as to the measure of credit to be given to the various professors who devoted their attention to the early development of the appliances used in making these communications. This may be indirectly a useful thing. For we have seen, from the recent discussion as to the place of Mr. Jonathan Hulls in the development of the marine steam engine, how hard it is after the lapse of years to discover the true history of great discoveries. Now it would appear that the controversy in regard to Marconi and his invention will be thrashed out thoroughly once and for all.

The Case of the Steamship "Tredegar Hall"

is one which greatly affects the position of marine engineers. It appears that the second engineer of that vessel had occasion to remonstrate with a fireman for loafing, whereupon the fireman in question proceeded to strike him a violent blow in the face. The case was laid before the British Consul at Sulina, but that official took no action in the matter, alleging that he had no jurisdiction to interfere. This is not an isolated case, for the master of the steamship *Shepperton* has also been assaulted by members of his crew who waylaid him and inflicted serious bodily harm upon him. This they did because he had taken them before the Consul for refusing duty. The Consul again declined to interfere, and stated that he had had a letter from the Board of Trade which prevented his taking any action in the matter. Though he felt himself precluded from taking any action as Consul, he, in the case of the master of the *Shepperton*, induced the shore authorities to proceed against the men. A number of officers of the Mercantile Marine joined with Captain Annison, the master of the *Shepperton*, in the protest which he addressed to the Board of Trade in regard to these two cases of refusal to punish insubordination, and since then the British Shipmasters' Association, of which he is a member, has taken the matter up, and requested the Board to publish the contents of the letter of which the Consul spoke, in order that the officers of the Mercantile Marine may know how they stand. But the matter is a wider one even than that. It is very questionable how far the Board of Trade is able to interfere with the Consul's jurisdiction in such matters, as it would appear that he is empowered by statute to act in regard to such offences, and that the Board is therefore powerless to attempt to regulate the matter.

This thing must be read in connection with the other recent action of the Board of Trade in issuing the circular to Local Marine Boards which has caused so much resentment in shipping circles. There it was ordered that representatives of the Seamen's Union, "not lawyers," were to be allowed to be present at the paying off of ship's crews. An almost unanimous refusal to act on this circular has been returned by the Local Marine Boards, and they are advised by counsel that the Board of Trade was acting beyond the scope of its authority in issuing it. But the letter to the Consul and the circular to the Marine Boards are much of a piece, and seem to evidence the fact that the department is determined to lessen the authority of ship's officers, and to destroy all attempts at the maintenance of discipline aboard ship. Interference of this kind is most mischievous. For it is much easier to break down than to build up, and unless something can be done, and that quickly, to restore their authority, the position of engineers and deck officers

who attempt to do their duty to their employers will be a far from enviable one.

Officers in the Mercantile Marine.

The recent complaints of the dearth of deck officers has induced certain Liverpool steamship owners to put forward a comprehensive scheme for the training of suitable material in a fleet of sailing ships to be owned by those who will in the future themselves employ their pupils. Many of the principal shipowners, including Mr. Bruce Ismay, Sir Alfred Jones, and representatives of the Cunard, Harrison, and other important lines, are interested in the scheme, which is fathered by Mr. Aubrey Brocklebank, the chairman of the Liverpool Steamship Owners' Association. It is too soon yet to discuss the details, which may be subject to considerable variation before the plan is finally considered. But, at all events, it is desirable to note here what is taking place, for marine engineers have a very solid interest in the provision of a superior class of officers for the bridge, since on them, and on their qualifications, so much of the safety and comfort of the vessel depends.

Disasters.

There have been one or two serious disasters during the last few days. Amongst these may be chronicled the loss of the iron paddle-steamship *Hankow*, burnt at Hong Kong. This vessel was bound for Canton, with a valuable cargo of silk and matting. She had on board some 2,000 Chinese passengers and seven Europeans, besides the British officers of the ship. Soon after coming alongside the wharf at Hong Kong, fire broke out, and spread with such rapidity that she was in flames, fore and aft, within, it is said, five minutes of the discovery of the outbreak. The greater part of the Europeans fortunately escaped, but there was no chance for many of the Chinese, who were surrounded by the flames and perished in hundreds. The *Hankow*, which was a big steamer of the Chinese river type, was practically a total loss.

The new steamship *Hyndford* got into the overdue list, and went to 70 guineas per cent. for re-insurance. She was on her voyage from Europe to the West Coast of South America. Then news came that she had stripped all the blades from her propeller off Cape Horn and was drifting north-east at the rate of thirty-six miles a-day. A steamer was sent off from Punta Arenas to look for her. But about three weeks had then already elapsed since she had been sighted, and it was feared that she might have passed the latitude of the Falkland Islands and gone away into the unfrequented parts of the ocean. This, however, fortunately did not occur. She was brought into safety at Stanley, in the Falkland Islands, on October 13th, and though she took the services of a tug at the last, it would appear likely that there will not be a large claim for salvage.

The well-known Millburn liner *Port Stephen* was abandoned at sea on October 8th, having fractured her tail shaft and broken her stern tube in lat. 49. 21 S., long. 164. 48. E. Those on board were fortunately rescued and brought to Dunedin. All hope for the safety of the vessel was not, however, given up, as the Union Company of New Zealand thought the circumstances warranted them in sending out one of their fleet, the *Rakanore*, to see whether the derelict was still afloat.

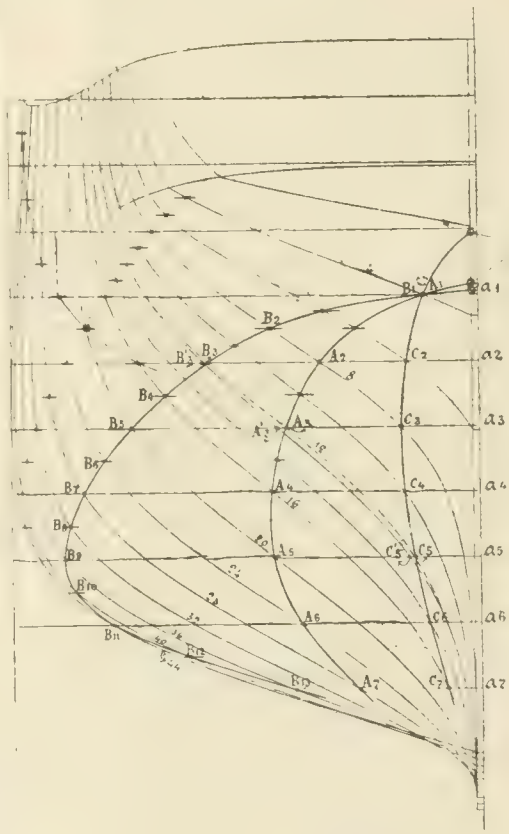
When the *Deutschland* crashed her bows into the Admiralty Pier at Dover and the Hamburg-American Line promptly announced the temporary abandonment of the port for their big passenger vessels, I ventured to express the belief that the absence of these vessels would be more than, as was then suggested, a temporary departure. The accident which occurred to the Swedish steamship *Olans Olssen*, on the morning of October 21st, does not make the return of the Hamburg vessels much more likely. The damage wrought by this accident is estimated at £40,000—a large sum enough. But though it strikes the public mind, owing to the loss of the Goliath cranes, the damage to the pier works and the wrecking of the decks of the steamship, it is more than probable that the cost of the *Deutschland* incident considerably exceeded that sum. There was the cost of repairs and docking, themselves no inconsiderable item. But there was the further fact that the crack passenger ship missed the trip for which she had embarked a full complement of passengers, whilst the repairs occupied a couple of months, at the very height of the passenger season. These losses do not strike the public eye like a broken pier or a fallen crane, but they are very real and very large nevertheless and are not likely to be forgotten by the shipowner, who has another reminder of Dover's dangers in the misfortunes of the *Olans Olssen*.

NEW METHOD OF FAIRING SHIPS' LINES.

IN this method advantage is taken of the fact that the traces of all planes with the ships' surface which are not at right angles to the transverse vertical plane, form, when projected on to the "body plan," curved lines; and these curved lines are utilised for "fairing up" the construction sections, or for plotting in intermediate sections.

In "fairing up" the line plan of a vessel, it has been usual to make use of the traces of planes mutually at right angles to each other with the vessel's surface,

Fig I



viz., transverse vertical, longitudinal vertical, and horizontal, and sometimes a diagonal plane, whose trace with the longitudinal plane, is horizontal. These in the hands of an experienced designer are sufficient to ensure the frame sections being of such form that the hull on completion will be fair and symmetrical; it is, however, essential that the designer should have considerable experience of the work to ensure a satisfactory result.

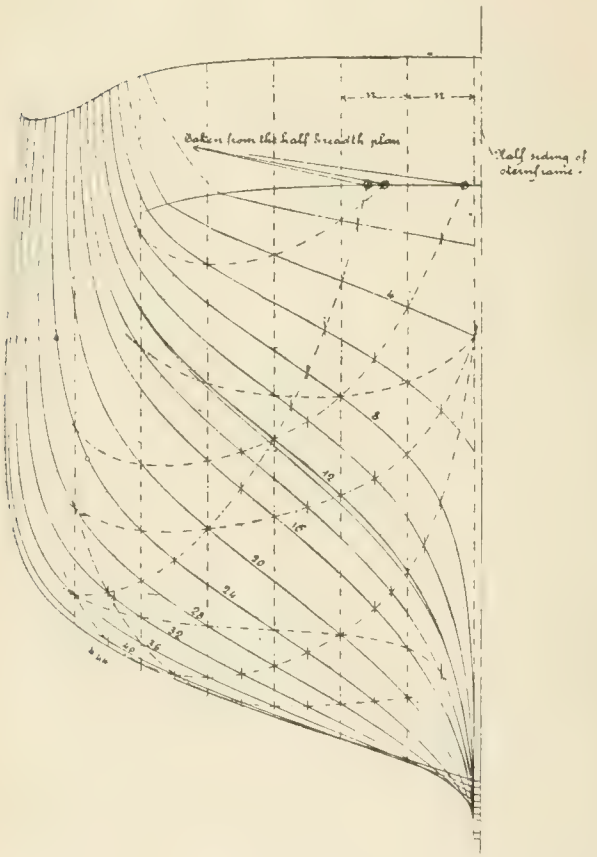
In the method now proposed it is believed that the work of fairing will be much simplified, while at least as accurate, and the curves having a more decided character, and being confined entirely to the "body plan," will be more easily faired, and any irregularity will be at once apparent.

It is not intended that this method should do away with either the "half breadth," or "sheer plan," as these will of necessity be required to enable the designer to see in miniature the actual form of the profile, water line, and deck lines of the vessel, but to facilitate the work of "fairing up" and to ensure the ready interpolation of intermediate sections.

The procedure in "fairing up" by Mr. Axel Tronier's method may be briefly explained as follows:—

The principal sections having been roughly drawn in on the "body plan," a number of equidistant parallel lines are also drawn thereon; these latter may be either horizontal, vertical, or may be inclined to any desired angle. These parallel lines are intended to represent

Fig II



the traces of an inclined plane or planes, with the planes of the several transverse sections, whose outline has been sketched in.

The horizontal lines represent the traces of planes horizontal in the transverse sense, but inclined longitudinally, the vertical lines represent the traces of planes, vertical, but inclined longitudinally, and the diagonal lines represent the traces of planes inclined in all three senses, that is, to the horizontal, vertical, and longitudinal.

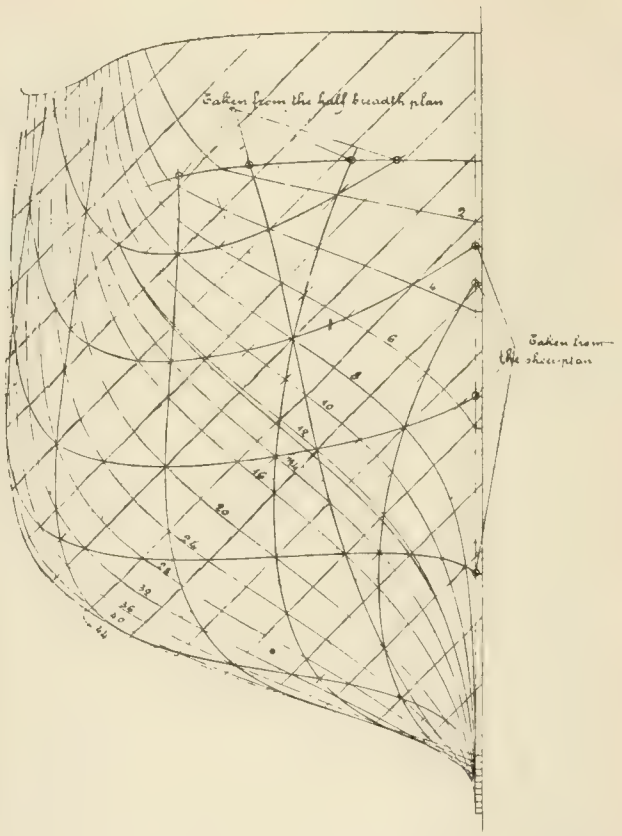
Drawing now a curved line through the points of intersection of adjacent parallels with adjacent sections, we have the projection of the traces of an inclined plane with the vessel's surface on to the plane of the "body plan."

To make the working clear, let us take the after "body plan" of a vessel, Fig. 1, and on it draw a number of parallel and equidistant horizontal lines a_1, a_2, a_3 . . . and as the sections 4, 8, 12 . . . are also equidistant longitudinally, the parallel lines a_1, a_2, a_3 . . . may be taken to represent the traces of a plane, transversely horizontal but inclined longitudinally with the planes of the sections 4, 8, 12 . . . respectively.

If we now draw a curved line through the points of intersection A_1, A_2, A_3 . . . of these traces with their respective sections, we will have, on the "body plan," the projection of the trace of the inclined plane with the vessel's surface.

It will be evident that if we take the points of inter-

Fig III



section B_1, B_3, B_5 . . . of alternate sections with adjacent parallels, we will have, in the curved line drawn through these points, the projected trace of a plane at (about) *half* the former angle, and conversely, if we take the points of intersection C_1, C_2, C_3 . . . of adjacent sections with alternate parallels, then we have the trace of a plane which has about *twice* the inclination of the former, and so on.

So that, given a sufficient number of parallels, we have a very handy means of running a series of fairing curves; for, as the projected traces of these planes with the ship surface must, to satisfy the requirements of a fair hull, be of themselves fair, any correction of the section which may be necessary is at once apparent.

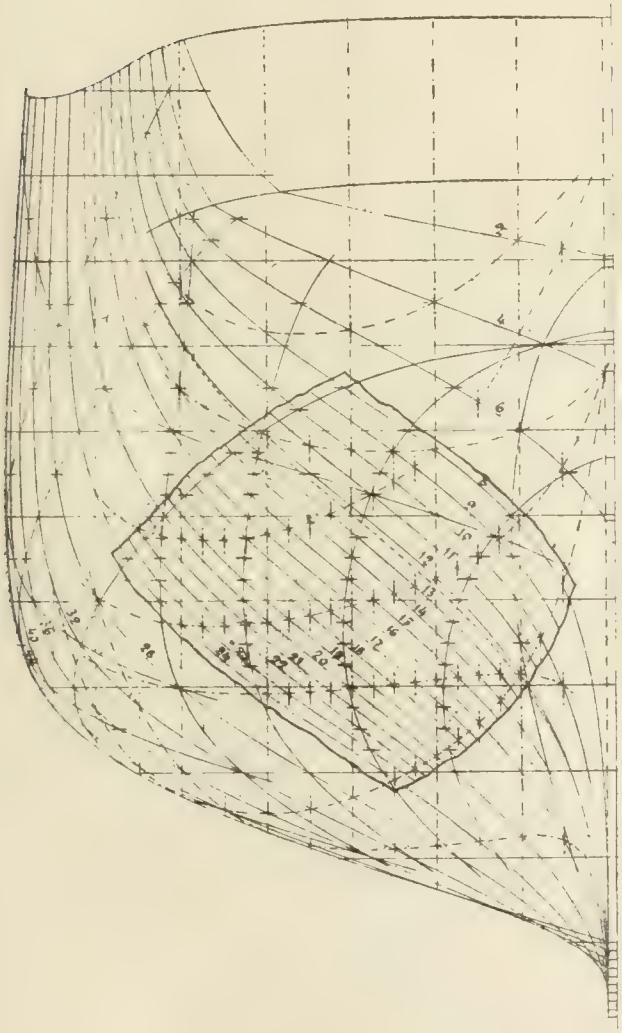
We see, for instance, on Fig. 1, that the traces A_1, A_2, A_3 . . . B_1, B_2, B_3 . . . and C_1, C_2, C_3 . . . must, to be

fair, leave the intersections B'_3, A'_3, and C'_5 of the parallel lines (a_2, a_3, a_5) with the section 12 and follow the course of the line as shown, and through the intersection B_3, A_3, C_5, which the latter makes with the parallels, must be drawn the corrected section 12, as shown dotted.

As we have done with the horizontal parallels, so we may do with the vertical ones, Fig. 2, except that in this case it is advisable to commence the spacing of

Fig IV

Fig II and III combined



these from the siding of the sternframe out from the centre line so as to simplify the endings of the traces projected on to the "body plan."

Fig. 3 shows the same after body but with a set of diagonal parallels.

Fig. 4 shows "body plan" with both vertical and horizontal traces for "fairing in" and also the interpolation of part of the frame sections 9, 10, 11 . . . 23.

In Figs. 2 and 3 the projected traces also show that section 12 as at first drawn in required modification.

As will be understood, of course either one, or two, or all three sets of lines may be used as thought advisable, and if it is thought undesirable to draw so many lines on the "body plan" itself, a piece of ruled tracing paper may be laid on the plan, the traces drawn in and the necessary corrections pricked through.

Should the spacing of some of the sections, longitudinally, be greater or less than the common interval, the spacing of the relative parallels will require to be proportional.

As will be understood, we are not confined to any one point of departure in drawing in these fairing curves, but may commence at almost any point we may desire, and carry the curve over that part of the "body plan," where its function will be most useful.

The endings for the projected traces on the "body plan," where such are considered necessary, must, of course, be taken from the "half breadth," or "sheer plan" and transferred to the "body plan."

The application of the method to the "fairing up" of the water lines on the "half breadth plan" and of buttocks in the "sheer plan" may be used with advantage, and here again the ruled tracing paper will be found to save considerable labour in "fairing up."

LLOYD'S REGISTRY OF SHIPPING.

THE report issued by the Committee of Lloyd's Register of Shipping for the year ending June, 1906, is an interesting document, showing not only what the shipbuilders and engineers of the country have been doing for shipowners, what the Committee of Lloyd's have been doing to safeguard the interests of all three, but, incidentally, what they have done to encourage and help the rising generation in the direction of technical study, by providing three scholarships at the Armstrong College, Newcastle, in addition to three at Glasgow University, and at the Royal Naval College, Greenwich, the latter dating back to 1878. We give prominence to this part of the report with pleasure, as it is probably not generally known to our readers that such scholarships exist by the kindly foresight and providing of the Committee, whose example might well be followed, in one direction or another.

The report states that at the end of June, 10,065 merchant vessels, registering over 19,000,000 tons gross, held classes assigned to them by the Committee. Of these, there are 3,798 British-owned iron or steel steamers of 11,265,139 tons, and 2,589 foreign-owned of 5,653,705 tons; 693 British-owned sailing vessels, of iron or steel, of 1,099,060 tons, and 724 foreign-owned, of 996,343 tons; 243 wood and composite British-owned steam or sailing vessels of 36,259 tons, and 20 foreign-owned of 8,851 tons. During the year, 652 steamers of 1,408,579 tons, and 10 sailing ships of 4,066 tons, were constructed under the supervision of the surveyors. In the year 1895-96, the steamers classed gave a tonnage of 860,930 tons, while the sailing ships gave 70,985. From that date till 1899-1900, there was a decrease in the tonnage of the sailing ships, and an increase in that of the steamers; the steam tonnage in this year, however, also fell below that of the previous year by 65,498 tons. From 1899-1900 to 1901-02, the steam tonnage rose and then fell till 1904-05; and the present year, again, shows a rise, and has attained the highest total, being 1,408,579 tons. The sailing ships continued to rise in tonnage till 1902-03, when it reached 68,155 tons. Since then it has fallen rapidly, and only reached 4,066 tons in 1905-06.

Referring to the largest steamers, it is stated that 39 have been classed during 1905-06 over 5,000 tons. The *Carmania*, 19,524 tons; *Nieu Amsterdam*, 16,967 tons (Holland-American Line); *Empress of Ireland* and *Empress of Britain*, 14,190; the *Mooltan*, *Delta*, *Devanha*, and *Delhi*, of 9,621, 8,535, 8,092, and 8,090 tons respectively, for the P. & O. Company; and the *Oriana*, of 8,066 tons, for the Pacific Steam Navigation Company.

During the year, the plans of 879 vessels of steel, 1 of iron, 18 of wood, 3 composite, and 1 part iron, part steel were submitted to the Committee, making a total of 902,

this being the highest number ever submitted in one year in the history of Lloyd's.

The amount of steel tested by surveyors of the Society reached a total of 1,002,413 tons. The surveyors employed now number 308.

The steamers built, or being built, with turbine machinery are steadily increasing in numbers and tonnage, and include 5 for the British India Steam Navigation Company; 1 for the Australasian United Steam Navigation Company; 1 for the Cunard Company (the *Carmania*); 1 for the London, Brighton, and South Coast Railway; 3 for the Fishguard and Rossclare Railway and Harbour Company; 1 for the Isle of Man Steam Packet Company; 1 for G. and J. Burns; and 1 for the General Steam Navigation Company; and the turbine yachts, *Albion*, *Emerald*, *Lorena*, and *Narcissus*. There are, besides these, 8 turbine steamers under way, including the *Lusitania* and *Mauretania*; while 2 are being built at Nagasaki over 13,000 tons—a fact which shows how the Japanese are going ahead.

The enormous trade which has been developed within the last twenty-five years in connection with frozen meat is referred to as having come largely under the supervision of the surveyors, several of whom have been specially appointed to devote themselves, as experts, in regard to the various systems of refrigeration now in use, embracing the machinery, the insulation, and the several details of each type. That the services of these surveyors have been appreciated, we have seen evidence to show. Not only has the carriage of frozen meat been greatly increased of recent years, but also that of dairy produce, and fruit of many kinds. It is said that the capacity of vessels engaged in carrying such produce amounts to an equivalent of 10,000,000 carcases of mutton. The report specially notes the increase of shipments from the Argentine Republic.

The work of the Engineering Standards Committee has engaged the attention of the Committee of Lloyd's, and an endeavour is being made to bring the rules of the Society into line with the standards recommended.

The changes which have been made in the rules relating to freeboard have greatly increased the work of the surveyors; and the cargo-carrying capacity of ships has been greatly in favour of the shipowner, in competing with those of other nationalities, whose non-liability to British law in such matters gives undue advantage.

The experiments in course of progress with gas engines for marine propulsion is touched upon in a paragraph of the report, and one of these is looked upon as "of considerable importance, being on a sufficiently large scale to give reliable data as to the working of more powerful engines of the type in question.

Extra First-Class Engineers' Examination.—At the examination held on October 9th, 10th, and 11th, the following succeeded in obtaining their certificates: Messrs. C. A. Hagen, Dunfermline, N.B.; W. H. Milner, Cork; W. L. Kidd, South Shields; H. A. Boultbee, Sheffield; T. Mayer, Dumbarton, N.B.; and W. C. Marshall, Carlisle. Of these, four passed the first time of going up, three being prepared by the system of postal tuition introduced by Mr. Thorn. That the system of teaching by correspondence (as carried out by Messrs. Thorn) is really efficient is evidenced by the fact that, out of the last 59 successes in the higher grade from this school, 29 were postal pupils, and 25 of these passed the first time of going up. All these students were prepared by Messrs. W. H. Thorn & Son, 5, Waterville-terrace, North Shields, from whose establishment have passed 145 extra first, 27 surveyors, and 6,800 ordinary grades.

The British Prometheus Company, Ltd.—A new illustrated catalogue has just been issued by the British Prometheus Company, Ltd., of Salop-street Works, Highgate, Birmingham, relative to their manufactures, in the way of electric convectors and radiators. In glancing through the catalogue, one cannot help being struck by the handsome design of the many heaters illustrated, and, with regard to their efficiency, it may be noted that they are substantially guaranteed, and have a minimum life of anything from five years upwards. We understand that, as a matter of fact, several heaters supplied five years ago and used in an underground transformer chamber have never been off circuit, and are to day in apparently as good condition as when first installed. This fact speaks for itself, and undoubtedly furnishes excellent evidence as to the reliability of this firm's productions.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

THE event of the month has, of course, been the departure of the *Dreadnought* for her trials. She went out of harbour on October 1st, barely a year from the laying of her first keel plates, that having been done on October 2nd, 1905. It seems hardly possible that such a great vessel should have been completed in such a short time; but there she was, complete in all respects. I will leave her trials to be dealt with elsewhere, and will only say here that they were thoroughly successful, and the official announcement was accepted as a great compliment by the constructive staff. As to the new ship, rumour says that she will not be laid down until January; but the general impression is that it will be at the end of November or the beginning of December. The building slip is being got ready, and a good deal of material has been accumulated; in fact, the same preliminary preparations are being made as were made with the *Dreadnought*. The work of lengthening No. 15 dry dock is to be taken in hand at once. This is the dock in which the *Dreadnought* was completed; and the increase in length is taken to mean that the new vessel will be longer than the name ship. The battleship *Britannia*, having completed her trials, has been commissioned for service in the Atlantic Fleet, in place of the *Majestic*, which vessel has joined the Reserve Division at this port. The torpedo section of the new factory, recently built for the engineering department, has now been opened for actual work. The motive power is supplied by electric motors, and the factory is also lighted by electricity. The remaining sections, it is anticipated, will be in working order by the end of the year, and the old factory will be taken over by the constructive department. Our new Admiral-Superintendent, Rear Admiral C. G. Robinson, succeeds Sir Henry Barry on November 9th, and, a week later, Rear Admiral Login, who was originally nominated for the post of Admiral-Superintendent, takes command of the Reserve Division, in place of Rear Admiral Cross. Before Admiral Cross goes, he will have the pleasure of having his squadron inspected by the Lords of the Admiralty, who are due at the end of the month. The review will take place at Spithead. The *Gladiator*, which went to Port Said with a new crew for the *Proserpine*, has returned, and is now attached to the Gunnery Establishment, in place of the *Grafton*, which is undergoing a refit. On her voyage from Gibraltar, the *Gladiator* ran special speed trials, and on a full-power trial attained 19 knots, which is greater than the designed speed. Seeing that she was built in 1896, and has done considerable work, this is highly satisfactory. She also averaged 19 knots on an economical coal consumption speed. The old Royal yacht *Royal George* is being broken up; she was the yacht of King George IV., and was last employed as a living ship for the crew of the old *Victoria and Albert*. Two of the sailing brigs which were attached to the *St. Vincent* are also to be broken up, the idea being to provide work during the coming slack period. The men are very disappointed at the non-appearance of the reorganisation scheme, which was expected at the beginning of October. The shipwrights and labourers expect to come in for additional pay.

Devonport Dockyard.

The arrival of the *Dreadnought*, on October 5th, was looked forward to with great interest, but when she steamed into the Sound no other warship was at anchor, so it was impossible to make comparisons; but in the afternoon the *Hibernia* returned from a steam trial, and we could then appreciate the size of the greatest warship on earth. A large number of officers of the ships in port and dockyard officials went on board, including Rear Admiral Barlow, the Admiral-Superintendent. To return to our own latest battleship, the *Hibernia*. Her steam trials have passed off with complete success, she having in her eight hours' trial maintained a mean speed of 18·3 knots, which is considered very satisfactory. Her gun trials, too, have been completed, although with regard to these very alarming rumours were set afloat. The fact of the matter appears to be that the concussion caused by the firing of the 12-in. guns damaged the stanchions and other light deck fittings, such as venti-

lators. The teak deck planks also opened in several places, and the upper deck was temporarily deflected. She is now being got ready to relieve the *Victorious*, as flagship of the second in command of the Atlantic Fleet, and will be completed for sea by December 21st. With regard to our new "Dreadnought," January 1st is mentioned as the probable date for laying her down. She will be built on the slip from which the *Minotaur* was recently launched, and workmen are now employed in placing the blocks in position. A large consignment of steel plates and other material has also been ordered from Messrs. Guest & Co. A new departure is being made in the case of the *Minotaur* from that hitherto followed. Up to the present, armoured cruisers have not been provided with net defence, but this adjunct is to be furnished to the *Minotaur*, and also, I understand, to her sisters, the *Shannon* and *Defence*. The *Minotaur* will have thirteen booms on each side, so stowed that the entire defence can be got into position in less than a minute. The battleship *Hannibal*, which has undergone an extensive refit, is now completed, and she was commissioned for service in our Reserve Division on October 20th. Experiments are to be carried out here in the spring in connection with the raising of submarines. The old *Reindeer* and *Mariner*, two vessels fitted in connection with the boom defence, are to be supplied with gear of sufficient raising power to lift the deadweight of the submarine to the surface. A submarine with 6-in. wire hawsers attached is to be sunk, and then the appliances on board the two gunboats tested in lifting her until the top of the periscope is above water. The two cruisers of the "Highflyer" class in our Reserve Division—the name ship and the *Hyacinth*—are shortly to be put in full commission. The former is to be ready by November 6th for the East Indies Station, and the latter by February. It is a coincidence that all three vessels of this class have done their chief service in the East Indies as flagships. The *Highflyer* served her maiden commission there from 1899 to 1903, then followed the *Hyacinth* and the *Hermes*, the present flagship. It is a coincidence, too, that the *Highflyer*, which was last commanded in the East Indies by Captain A. H. Christian, should be at present commanded by Captain C. A. Christian. Vice Admiral Sir Lewis Beaumont, the Commander-in-Chief at this port, has received well-deserved promotion to Admiral. I am told that it is quite likely that he will go to Portsmouth next February to succeed Admiral Sir Archibald Douglas, as Commander-in-Chief there.

Sheerness Dockyard.

The yard has at present a very busy aspect, for the steam basin is full of vessels refitting, and the docks are all occupied, in addition to which all the departments have plenty of work to keep them going for some time. The arrangements for the electrification of the yard are being gone on with, and the work in connection with the extension of Nos. 4 and 5 Docks is also proceeding apace. The sloop *Merlin*, which has been refitted for surveying service, will probably have left by the time this is in print for China, to take up her duties there. She has been painted white, and very smart she looked when she moved into the stream. It is safe to say that no surveying vessel has ever been passed out of dockyard hands so well equipped for service as the *Merlin*, and it is a matter for congratulation that some useful employment has been found for this class of vessel, seeing that they were discarded after such a brief period of service, which, in the case of the *Merlin*, was barely two years. The *Fantome*, a sister vessel, has been placed in hand to be similarly converted, and she is to be ready by January for the Australian Station. The surveying vessel *Goldfinch*, which recently returned here from the West Coast of Africa to be refitted, is not to be refitted after all, the proposal having been abandoned, on account of her defective condition, and she will accordingly be sold out of the service. The sloop *Mutine*, now lying at the Motherbank, off Ryde, with a number of non-effective ships, is, I understand, to take her place. She will, however, be fitted out at Chatham. The *Mutine*, although on the "scrap-heap," is by no means an old vessel, for she was only built in 1900.

The new battleship *Africa* is to be commissioned at this port on November 6th, to relieve the *Magnificent*, in the Atlantic Fleet. With the withdrawal of the latter vessel, the only battleship of the "Majestic" class left in that fleet will be the *Victorious*, and she is shortly to be replaced by the *Hibernia*. The Atlantic Fleet will then consist of eight battleships of the "King Edward" class—a homogeneous squadron such as no other Power but Britain possesses. When the New Year comes, Sheerness will lose something of its importance. At present the Commander-in-Chief at the Nore flies his flag in the *Wildfire*, at Sheerness, but when Admiral Sir Gerard Noel succeeds Admiral Sir Hugo Pearson, a change will be made. An official residence has been built at Chatham, and that port is to be the headquarters instead of Sheerness.

Chatham Dockyard.

Although it has been definitely announced that it has been decided not to build any more large vessels here, there is an impression abroad that we shall be given a cruiser to construct next year. Pressure will, no doubt, be brought to bear on the Admiralty, but there is little prospect of its success, and Chatham will have to rest content with repair work and the construction of a few small vessels. One thing is certain. If the sum to be spent on new construction is to be reduced to a minimum, the fleet must be kept in a condition to be prepared for emergency, and more money will be spent to keep the vessels fit. Ships, of course, are better cared for than they were a few years ago; but still there is room for improvement. The blocks on which the three 500-ton lighters are to be built are being prepared in No. 8 slip, from which the *Africa* was launched. They are to be completed by the end of the financial year. As I have said before, it is a great drop from battleships to lighters; but we must be thankful for small mercies. One cannot, however, help thinking that it is absurd to utilise a slip designed to accommodate battleships, and provided with up-to-date machinery and workshops, for the construction of lighters. A few years ago, several of the small slipways were converted into storehouses. The *Africa* is now practically completed, and will leave in a few days for Sheerness to be commissioned, and the *Shannon* is well advanced. Instructions have, therefore, been sent from the Admiralty to press forward the repairs of the *Albion*, *Bedford*, *Amphitrite*, and *Charybdis*. The completion of the *Shannon* is providing employment for quite a small army of men, while the contractors for the machinery (Messrs. Humphrys, Tennant & Co., Deptford) are losing no time in expediting their work.

The work of repairing the destroyer *Thrasher*, which was damaged by stranding in Bantry Bay, has been taken in hand; and several more of these small craft are expected shortly. The refit of the *Sutlej* has been completed, and she has left to rejoin the Fourth Cruiser Squadron. Among other expected arrivals is the battleship *Illustrious*, of the Channel Fleet, which is to be the flagship of Rear Admiral Callaghan, when he succeeds Rear Admiral Groome on November 16th. Her stay, however, will be of short duration, as there are only a few minor alterations to be made.

Pembroke Dockyard.

A remarkable query was recently received from the Admiralty regarding the vessel that we are going to build here, which, it may be remembered Mr. Robertson referred to as a mother ship for destroyers, and Lord Tweedmouth referred to as an improved scout. The official inquiry was as to the probable date that the anchors and cables for the new ship would be required. Seeing that the design of the vessel has not yet been prepared, the query was certainly a little bit premature. The Wallsend Slipway and Engineering Company, who have the contract for the propelling and other machinery of the *Warrior*, are expediting their work so as to have it completed during November. Although the date for the departure of the ship for the steam trials has not yet been definitely fixed, November 15th is spoken of as a likely date, and December 6th as the date for the commencement of the trials. The date for the launch of the *Defence* will be settled by Mr. Ollis, the new chief constructor, and it will probably be at the beginning of the New Year. The engineer contractors are well ahead with the preliminary work. The under-water fittings are complete, and all the auxiliary machinery in the boiler and engine-rooms, including steering engines, evaporating and distilling plant, and all feed and other pumps, are on board. The work on the hull generally is also in a forward state. The estimate of £7,730, for the refit and adaptation of the distilling and tank vessel *Aquarius*, as a fleet repair ship, has been approved. The remaining two 12-in. guns of the *Montagu*, as well as a quantity of shell, together with propellers and other gear, has arrived here from Lundy Island. It is expected that a grant will be made to defray the expense incurred during the salvage operations. The workmen, too, are expecting to receive some compensation in consideration of the dangerous character of the work at

Lundy Island. The dockyard railway extension is now completed, and it is possible to make a complete circuit of the yard. Rear Admiral Denison, our late Captain-Superintendent, left on October 1st, but before leaving us, he issued a minute thanking all the officers for the loyal support he had received from them, and expressing satisfaction with the manner in which the work at the yard had been performed during his superintendency.

R.M.S. "ARAGUAYA."

At the invitation of the chairman and directors of the Royal Mail Steam Packet Company, some 900 guests travelled by special trains from Waterloo to Southampton on October 6th, to see the latest addition to its fleet, and make a short run in the Solent, which was in every way successful. The *Araguaya*—whose dimensions are: Length, 535 ft.; breadth, 61 ft. 8 in.; depth, 43 ft.; with a gross measurement tonnage of 10,537—is in many respects the most luxurious commercial vessel in the world, and one could not but admire the conspicuous refinement which characterises the passenger accommodation generally, the fittings being those of a magnificent modern hotel.

We must refer our readers to the long description of the vessel, which we gave in our June 15th issue, at the time of the launch, by Messrs. Workman, Clark & Co., Ltd., Belfast, and confine ourselves more particularly to the engine-room and auxiliary machinery.

The main engines are of the four-cylinder quadruple-expansion type, constructed by the builders, having ample bearing surface and strongly designed, the cylinders being 27 in., 38 in., 56 in., and 76½ in., by 4-ft. 6-in. stroke. Steam is supplied by six Scotch boilers, three double-ended and three single-ended, of the Deighton make and form, and of the withdrawable type, with, in all, thirty-six furnaces, working at a pressure of 215 lb. per square inch, under forced draught. The smoke-box doors of all the furnaces are fitted with Silley's patent fastenings, which effectually prevent the chance of buckling of the doors or leakage of air. Messrs. G. & J. Weir, of Glasgow, have fitted a pair of their patent direct-acting feed-pumps, 12½ in. diameter by 17 in. steam cylinders by 24-in. stroke, with cast-iron float-tank, and control-gear for automatically regulating the speed of the pumps, in accordance with the supply of feed-water available. Each pump is capable of supplying the boilers, when the main engines are developing 8,000 I.H.P., at a speed of 10 double strokes per minute. The water ends of the pumps are entirely of gunmetal, fitted with gunmetal liners, gunmetal buckets, with special ebonite packing rings, cold-rolled manganese bronze rods, and bronze valves of the Weir group type, in gunmetal seats. The installation is of their latest and most approved type for high-class merchant vessels. The Liverpool Engineering and Condenser Company, Ltd., supplied a Quiggin's patent evaporator of 50 tons capacity for twenty-four hours, which was complete with all the usual mountings, including a patent automatic feed-water regulator, for controlling the delivery from the feed supply; a Quiggin's patent exhaust steam feed-water heater, the main feed pumps delivering the feed water to boilers through the coil surface in this machine, and it is heated by the auxiliary exhaust steam on the outside of same. The coils are of Quiggin's patent multiple thread type, so as to give a large sectional area through same, and also divide the feed-water into a number of small streams, rendering the machine thereby highly efficient, and a Quiggin's patent distilling condenser of 5,000 gallons capacity per twenty-four hours. Messrs. Clarke, Chapman & Co., Ltd., of Gateshead-on-Tyne, have fitted on board the windlass, which is of their direct steam type, with vertical engine, having two cylinders, each 12 in. in diameter by 14-in. stroke, fitted with link motion valve-gear, warp ends fitted on the intermediate shaft for quick warping, and clutch-gear for disengaging from body of windlass, and all bearings bushed with gunmetal, and fitted with their latest type of positive clutch action for hauling, and powerful wood-lined screw band-brakes for veering; also the boat-hoisting winch, fitted with horizontal engines, having two cylinders, each 6 in. by 10-in. stroke; and they have fitted out the vessel with a very complete set of independent pumps, Woodeson's patent. They are chiefly used for hot and cold salt water, hot and cold fresh water, ballast, bilge, feed, and the usual necessary connections on board ship. All the duplex pumps are fitted with gunmetal ends. In the main engine-room is a large hydraulic pump, driven by a compound surface-condensing steam engine, by Brown Brothers, of Glasgow. This hydraulic engine works the whole of the hydraulic cranes for discharging the holds, two cranes being fitted to every hatchway. The refrigerating installation on this vessel is in several respects interesting, and represents the latest development in the carriage of chilled beef and other products of Argentina. Generally speaking, the plant is similar to that which Messrs. J. & E. Hall, Ltd., installed on the R.M.S.P. *Aragon*, the first of the great new steamers which the Royal Mail Company have put on their South American passenger service. As might be expected, however, there has been no finality in this connection, and the installation on the present vessel represents several steps in advance of that on the R.M.S.P. *Amazon*, which in itself was a development as compared with the *Aragon*.

The entire insulated capacity is available for the carriage of chilled beef, and with that object, the arrangement of the brine service and of the cooling pipes in the chambers has been very carefully thought out. The brine pumps are of exceptional power, and there are a very large number of separate circuits, with the object of promoting an even distribution of the cooling effect, and of working the brine at the most economical and efficient temperatures. The results already achieved on the above steamers have been highly satisfactory, the recorded variations of temperature in the chilled beef spaces having proved negligible; but experience, carefully considered in such cases, can always lead to some improvement, at least in detail, and with that in view, it has been the aim of the company, and of Messrs. Hall, the designers and makers of the refrigerating machinery, to go one better on their previous best.

The plant consists of one of Messrs. Hall's large horizontal duplex CO_2 machines, combined with compound surface-condensing engines of their well-known standard marine type. Owing to its compact design, it has been possible to get this powerful machine, with its condensers and evaporators, into the space between the propeller shaft immediately abaft the thrust-blocks, thus utilising a part of the vessel which is very often more or less wasted. As each half of the machine forms a complete refrigerating unit in itself, capable of independently dealing with a complete cargo, the risk of breakdown is practically *nil*.

The brine arrangement provides for its economical distribution at the two temperatures required for chilled and frozen produce respectively, three large duplex pumps being installed, with interchangeable connections, allowing of one being always in reserve.

Several compartments are specially arranged for use for fruit or dairy produce, as an alternative to meat, and the rooms for ship's provisions are very complete, providing for the separate storage of the various descriptions of perishable foods.

An ice-making tank, water and wine coolers, and cupboard coolers, are among the other accessories, all in accordance with the most recent and approved practice for large passenger vessels of the highest class. The brine pipes, meat rails, and other ironwork throughout, are galvanised; and it may fairly be said that nothing has been omitted which might be considered in the present state of knowledge on the subject to contribute to the highest efficiency.

The electric lighting is very complete and extensive in its connections. The vessel throughout is electrically lit, and, at the same time, all auxiliary machinery, such as pantry and galley machinery, laundry, and ventilating-fans are worked by electric current; also every first and second-class passenger's berth has an electric cabin fan. The total number of lights are somewhere about 3,000.

Davidson & Co., of Belfast, supply Sirocco fans, not only in the stokehold, but throughout the ship, and See's ejectors and a patent ash-hoist are to be seen. The vessel had a preliminary trial trip in Belfast Lough before leaving, when the maximum revolutions of 87 per minute were reached, and a total I.H.P. of 8,870. The vessel afterwards proceeded to Southampton, and, during the run round, further tests were made of a most satisfactory character.

The vessel sailed for Buenos Ayres on her maiden voyage on October 12th, under the command of Captain James Pope, who has had some thirty years' service with the company, the propelling and auxiliary machinery being under the care of Chief Engineer N. G. Pearse, who has been at Belfast during the last three years superintending the construction of Royal Mail steamers. Mr. Pearse has been in the employ of the company for twenty-eight years, and was chief engineer of the steamer *Thames*.

DEVELOPMENT OF THE MARINE STEAM TURBINE.*

By the Hon. C. A. Parsons, C.B. (Past President), and Mr. R. J. Walker.

During the last few years the steam turbine has formed the subject of many papers read before various leading institutions, and its different applications have often been referred to.

It is hardly within the scope of this paper to deal in detail with the earlier experiments and trials which have led up to the present satisfactory position of the turbine. It may be of interest, however, to briefly describe the various steps that have been made from time to time in the development of same.

In 1884 the first Parsons' compound steam turbine engine was built, and was applied to the driving of a dynamo. This engine was designed for 10 H.P., with a modified high-speed dynamo, and for a working speed of 18,000 revolutions per minute. It ran for some years, doing useful work, and is now in South Kensington Museum.

Subsequently, efforts were made towards the construction of engines of larger sizes, which resulted, in the year 1888, in several turbo alternators of 120 H.P. being supplied for the generation of current in electric light stations, and at that period the total H.P. of turbines at work reached in the aggregate about 4,000, all of which were of the parallel flow type and non-condensing.

In 1892 the steam turbine was first adapted to work in conjunction with a condenser. This engine was capable of developing 200 H.P., at a speed of revolutions of 4,800 per minute, and drove an alternator of 150 kilowatt output. It was tested by Professor Ewing, F.R.S., and the result of the test showed a consumption of steam of 27 lb. per kilowatt hour, which is equivalent to about 16 lb. per I.H.P., with steam moderately superheated and a vacuum of 28 in.

Since then, various improvements have been made, until, at the present time, the steam turbine is generally recognised to be an efficient and practical engine which, in the larger sizes, has attained a high degree of economy in steam.

The following table shows the advance made in sizes and increased economy in steam consumption as applied for electrical purposes:—

Date.	Capacity.	Steam per Kilowatt Hour.	Vacuum.	Superheat.	Steam Pressure per sq. in.
	Kilowatts	Lbs.	Inches.	Degs. F.	Lbs.
1887	75	50·00	—	—	120
1892	100	27·00	27	50	
1898	1250	18·81	28	180	130
1901	1000	17·30	27	198	150
1902	3000	14·74	27	235	138
1904	4000	15·40	28·7	150	200

Superheating of the steam has been adopted in the case of land turbines, and it has been found by experiments that for every 10 deg. F. of superheat, the steam consumption is reduced by about 1 per cent.

Fig. 1, which is based upon a large number of tests, shows the steam consumption of different sized plants per kilowatt hour without superheating, from which it will be noted that the efficiency increases steadily as the size grows larger.

Turbine engines are also used for generating electrical current for the transmission of power, the working of electric tramways, railways, electric pumping, coaling, and similar purposes. They are also used for coupling direct to and driving fans for producing forced and induced draught for general ventilating purposes; also for driving centrifugal and screw pumps, and also for the more important work of driving blowers for supplying air under pressure for blast furnaces and other purposes.

* Read at a meeting of the Institute of Marine Engineers, at the Engineering and Machinery Exhibition, Olympia, on September 29th, the Right Hon. Lord Pirrie in the chair.

Land turbines have been very largely adopted in the past few years for the generating of electricity, judging from the fact that these machines are running in the power stations of some forty corporations and of twenty-five public electric supply companies. One of the largest power stations in England, now approaching completion, contains two units of 3,000 H.P. and six units of 6,000 H.P. each.

The total H.P. of turbines of the Parsons type delivered and on order, including turbines at work and under construction by licensees on the Continent and in the United States at the present time for land purposes is nearly 2,000,000 H.P. The installations now on order include units of upwards of 10,000 H.P.

The application of the steam turbine to the propulsion of ships has attracted a great deal of attention in the shipbuilding world within the last few years.

It was not until the year 1894 that the idea of propelling a vessel by means of a steam turbine was put into practical form. The *Turbinia*, as is now generally known, was the first vessel to be fitted with turbine engines, and between the years 1894 and 1898 many experiments were made with the *Turbinia*, necessitating radical changes in the design and arrangement of the machinery. The first engine which was tried was of the radial flow type, giving about 1,500 H.P. to a single screw. The results, however, were far from satisfactory, a speed of only 18 knots being obtained. Several different propellers were tested with this engine, and the results, compared with the power registered by a dynamometer, showed in every case a very low propeller efficiency. The original turbine engine was removed, and the engines finally adopted consisted of three turbines in series—high-pressure, intermediate-pressure, and low-pressure each driving a separate shaft, with three propellers

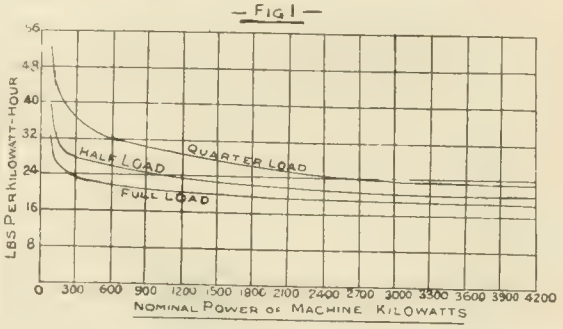


FIG 1
LBS PER KILOWATT-HOUR
56
48
40
32
24
16
8
HALF LOAD
QUARTER LOAD
FULL LOAD
0 300 600 900 1200 1500 1800 2100 2400 2700 3000 3300 3600 3900 4200
NOMINAL POWER OF MACHINE KILOWATTS
STEAM PRESSURE 150 LBS SQUARE INCH VACUUM AT FULL LOAD 27 INCHES AT HALF LOAD 27½ INCHES AT QUARTER LOAD 28 INCHES BAROMETER 30 INCHES
STEAM CONSUMPTION OF TURBINES

on each shaft. A reversing turbine was coupled with the low-pressure turbine to the central shaft. Very exhaustive trials were carried out by Professor Ewing in 1897. A full account of these trials will be found in the "Transactions of the Institution of Naval Architects," Vol. XLV. (1903).

Following the success of the *Turbinia*, the torpedo-boat destroyers *Viper* and *Cobra* were built and fitted with turbine machinery for the Royal Navy, and achieved remarkable speeds, the *Viper* taking the position of being the fastest vessel in the world, having attained the phenomenal speed of 36·86 knots per hour. Unfortunately, however, the *Viper* ran on the rocks of the Channel Islands in a fog, and ultimately became a total wreck. The *Cobra* foundered in a storm. Thus, after two or three years of hard work, the *Turbinia* was the only vessel afloat fitted with turbine engines.

About this period very great difficulty was experienced in endeavouring to induce railway companies and owners of mercantile vessels to build a turbine boat. Each company appeared anxious that someone else should make the first experiment.

The marine turbine was first adopted for commercial purposes in the Clyde steamer *King Edward*, to the order of Captain Williamson, in the summer of 1901. So successful was this vessel during the first season's running on the Clyde (the year of the great Exhibition at Glasgow), that an order was placed for a second vessel, *Queen Alexandra*, and the performance of these two vessels running on the

Firth of Clyde demonstrated the commercial advantages accruing from the adoption of the turbine system.

Other vessels quickly followed the *King Edward* and *Queen Alexandra*, until there are at the present time thirty-one turbine vessels in service for commercial purposes, representing a total of about 105,000 gross tonnage and 235,000 I.H.P.

The following table will, perhaps, best represent the various steps in the adoption of the turbine engine for commercial purposes:—

Name of Vessel.	Owners.	Dimensions.	Gross Tonnage.	Approx. I.H.P.	Year Built.
King Edward	Turbine Steamers, Ltd.	250 × 30 × 17¾	562	3500	1901
The Queen	S.E. and Chatham Railway Co....	310 × 40 × 25	1676	7500	1903
Virginian and Victorian ...	Messrs. J. & A. Allan	520 × 60 × 41	10754	12000	1904
Carmania	Cunard Steamship Co., Ltd. ..	678 × 72 × 52	19524	21000	1905
Lusitania and Mauretania ...	Cunard Steamship Co., Ltd. ...	785 × 88 × 60½	ab 33000	70000	Now building

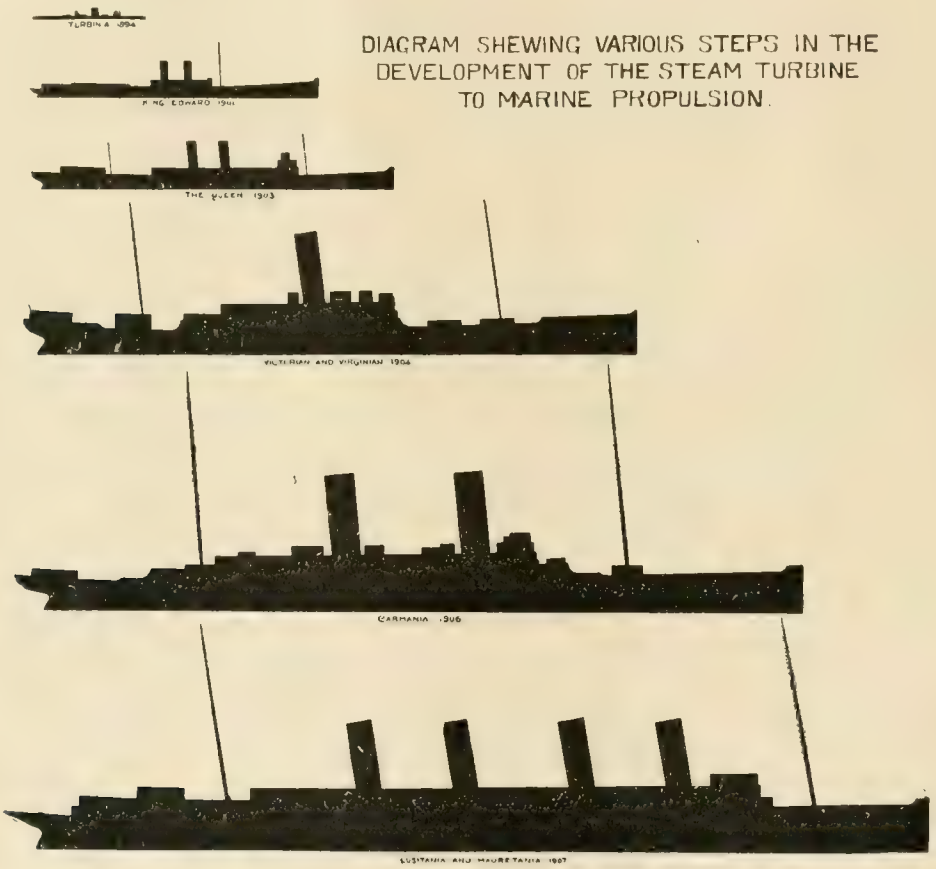


DIAGRAM SHEWING VARIOUS STEPS IN THE DEVELOPMENT OF THE STEAM TURBINE TO MARINE PROPULSION.
TURBINIA 1894
KING EDWARD 1901
THE QUEEN 1903
VICTORIAN AND VIRGINIAN 1904
CARMANIA 1905
LUSITANIA AND MAURETANIA 1907

Fig. 2.

Fig. 2 shows, in diagrammatic form, the comparative sizes of the various steps in marine propulsion. The profile of the vessels shown are to the same scale, beginning with the *Turbinia* of 100 ft. in length, 44 tons displacement, and 2,000 I.H.P., to the express Cunarders, *Lusitania* and *Mauretania*, of 785 ft. length, 45,000 tons displacement, and 70,000 I.H.P. each.

As regards war vessels, the destroyers *Velox* and *Eden* were the next vessels following the *Viper* to be built for the British Admiralty. These two vessels were fitted with additional engines for obtaining economical results when cruising at low speeds.

The next vessel to be fitted with turbines for the British Admiralty was H.M. third-class cruiser *Amethyst*. This vessel was also fitted with cruising turbines, and the results of the trials, as compared with sister vessels ordered at the same time as the *Amethyst* and of the same dimensions and lines, but fitted with reciprocating engines, demonstrated the economy of the Parsons marine turbine as fitted in this class of vessel, and more especially at the higher powers.

H.M. battleship *Dreadnought* is one of the latest war vessels to be fitted with turbine engines.

By the courtesy of M. Pierrard, of the Belgian Government, particulars are just to hand of the first season's running of the turbine steamer *Princesse Elisabeth* on the Ostend and Dover service, and are given in the following table, along with the particulars of similar vessels on the same service, but fitted with paddle engines:—

	Princesse Elisabeth.	Princesse Clementine	Marie Henriette.	Leopold II.
Length between perpendiculars ..	104·85m	103·70m	103·70m	103·70m
Breadth	12·192m	11·58m	11·58m	11·58m
Mean draught ..	2·92m	2·85m	2·82m	2·82m
Displacement in metric tons ...	2005	1853	1847	1829
Registered tons ...	1747T*	1474T*	1450T*	1375T*
Type of engines ...	Turbines	Comp.	Comp.	Comp.
Speed on trial ...	24 knots	22·187kts	22·2 kts	22 knots
Date of construction .	1905	1896	1893	1893

In the year 1905 the mean consumption of coal per single trip and the mean time per trip from Ostend to Dover and *vice versâ*, of the four preceding vessels were as follow:—

	Princesse Elisabeth.	Princesse Clementine.	Marie Henriette.	Leopold II.
Total number of trips ...	82	278	278	232
Mean duration of trip ...	187 min.	217 min.	212 min.	227 min.
Mean consumption per trip	23·01T	24·05T	23·82T.	24·30T

For the six first months of the year 1906 the corresponding results were the following:—

	Princesse Elisabeth.	Princesse Clementine.	Marie Henriette.	Leopold II.
Total number of trips ...	134	132	106	44
Mean duration of trip ...	185m.2s.	210m.5s.	206m.4s.	202m.4s.
Mean consumption per trip	22·71T	23·22T	24·27T	24·87T

	Turbine Boat.	Mean Results Paddle Steamers.
Total number of trips	216	1070
Mean duration of trip	185m. 9s.	215 min. 4 sec.
Mean consumption per trip ...	24·08T	24T

From the above table it will be seen that the turbine boat does the passage in about 15 per cent. less time than the paddle steamers, on the same coal consumption. To reduce the turbine boat to the displacement and speed of the paddle boats, and assuming that the I.H.P. varies as the cube of the speed, the mean consumption of the *Princesse Elisabeth* would be about 17 tons, as against 24 tons in the paddle boats, thereby showing a saving of over 25 per cent.

The following mercantile vessels have been completed and placed on service this year:—

The pleasure and mail steamer *Rewa*, for the British India Steam Navigation Co., Ltd., of 455 ft. by 56 ft., and 16½ knots speed; the new Clyde passenger steamer *Duchess of Argyll*, for the Caledonian Steam Packet Co., of 250 ft. by 30 ft. beam, 20 knots speed; the Thames passenger steamer *King Fisher*, for the General Steam Navigation Co., of 275 ft. by 32 ft., and 20 knots speed; the three cross-Channel steamers for the Great Western Railway Co.'s new route, Fishguard to Rosslare, *viz.*, *St. David*, *St. Patrick*, and *St. George*, of 350 ft. by 41 ft. by 13 ft. 6 in., and 22½ knots speed; the cross-Channel steamer *Viper*, for Messrs. G. & J. Burns, of 315 ft. by 39 ft. 6 in., by 12 ft., and 21¾ knots speed; and another Clyde passenger steamer, the *Atlanta*, for the Glasgow and South Western Railway Co., of 210 ft. by 27 ft. by 10 ft. 6 in., and 17½ knots speed. In addition to the above, the two Great Central Railway steamers are nearing completion, and will, it is anticipated, be put on service this year; and the yacht *Mahroussa*, which has been re-engined by Messrs. A. & J. Inglis, has run her trials, when a speed of 17½ knots was attained.

In addition to the large number of war vessels that are now being built and fitted with turbine machinery by some eight of the Parsons' Marine Co.'s licensees, and also in addition to the two express Cunarders, by Messrs. J. Brown & Co., and Messrs. Swan, Hunter & Wigham Richardson, Ltd., and the Wallsend Slipway & Engineering Co., the following mercantile orders are in hand: Two large ocean-going liners, by the Fairfield Shipbuilding & Engineering Co; two cross-Channel steamers for the South Eastern & Chatham Railway, similar to the *Onward* and *Invicta*; and a further steamer for the Union Steamship Co., of New Zealand, by Messrs. Denny; two large sets of turbine engines for shipment to Japan, by the Turbine Co., at Wallsend; and the Royal yacht, building by Messrs. Inglis, the turbine engines for which are being manufactured at the Turbinia Works, Wallsend, representing a total I.H.P. of work in hand of about 590,000.

Although the turbine itself has been described in various publications which are now being issued, it may be of interest to some of the members to briefly describe the principle of the Parsons' turbine, and to mention a few points incidental to the application of the turbine system to different classes of vessels.

In regard to the arrangement of turbines, this partly depends on the condition of service, and the various classes of vessels require, more or less, to be taken upon their own merits. The arrangement which has been almost universally adopted in the mercantile marine is that of dividing the power equally over three shafts, *viz.*, a high-pressure on the centre shaft, exhausting into two low-pressure turbines, one on each side of the vessel. Fig. 3 shows a three-shaft arrangement of machinery. In such a case the high-pressure turbine is made suitable for an expansion ratio of about 5, and the low-pressure for 25.

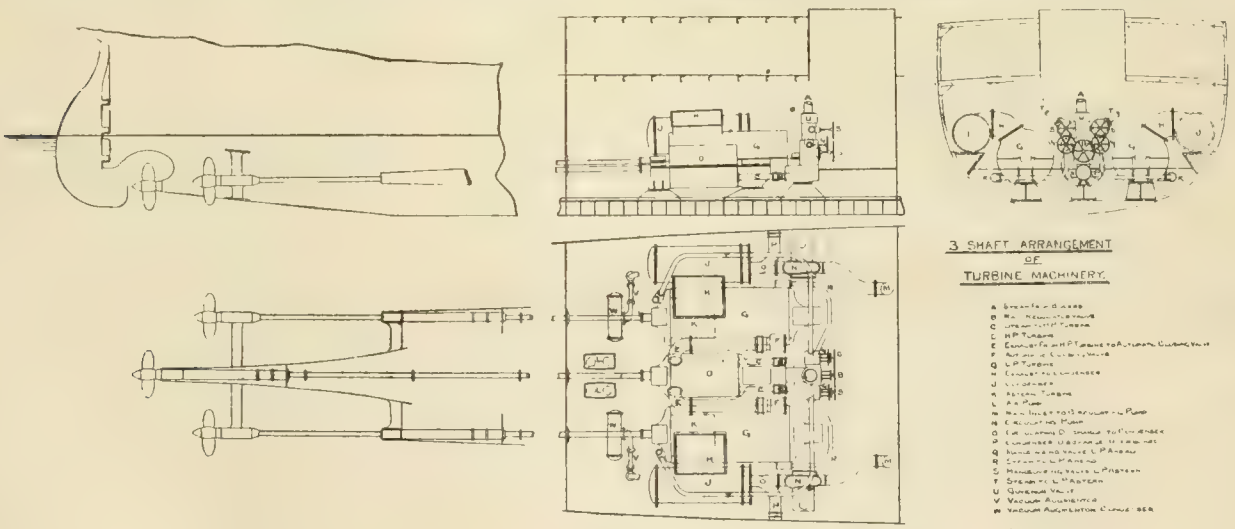


FIG. 3.

The turbines are of the parallel flow type, the general course of the steam through them being parallel to the axis.

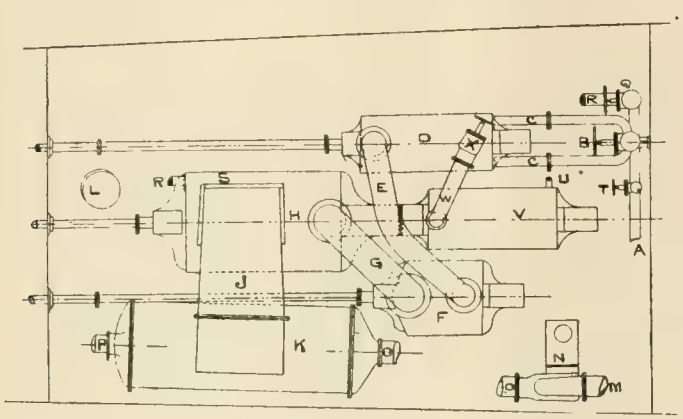
Each turbine consists of a number of rings of blades, or

vanes, mounted on a drum, or rotor. This rotor is enclosed within a cylindrical case, upon which rings of blades are also fitted. The rings of blades are alternately fixed and moving, that is to say, the blades in the cylinder are stationary or guide blades, whilst the blades fitted on the drum are moving blades. The diameter of the drum is less than the cylindrical case, and thus an annulus is left between the two, which is occupied by the blades referred to. Steam issuing from the boilers flows through the first row of fixed, or guide blades on the cylinder; it then, in to the expansion in volume of the steam for the range of pressures from the beginning to the end of the turbine.

The turbine shaft is coupled to the propeller shafting, and the thrust of the propeller is steam borne by the following arrangement:—

Forward of the steam inlet a dummy piston is fitted of reduced diameter to that of the main drum. A large number of small grooves are turned in this dummy piston, into which fit corresponding fixed brass rings which are bedded into the dummy casing, forming steam baffles. The

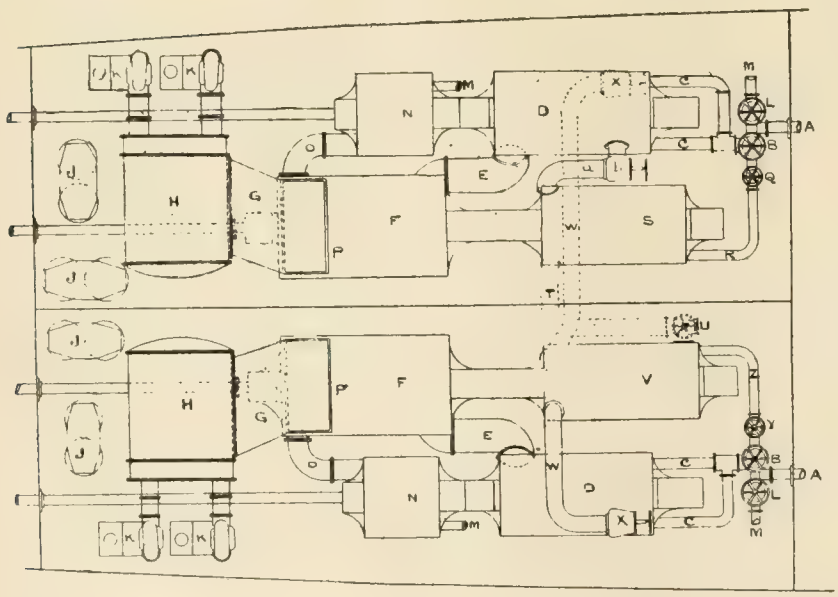
3 SHAFT ARRANGEMENT OF TURBINE MACHINERY IN SERIES.



A Steam From Boilers
B Main Regulator Valve
C Steam to H P Turbine
D H P Turbine
E Exhaust From H P Turbine to I P Turbine
F I.P Turbine
G Exhaust From I P Turbine to L P Turbine
H L P Turbine
J Exhaust to Condenser
K Condenser
L Air Pump
M Main Inlet to Circulating Pump
N Circulating Pump
O Circulating Discharge to Condenser
P Discharge Overboard
Q Astern Regulator Valve
R Steam to Astern Turbine
S Astern Turbine
T Cruising Regulator Valve
U Steam to Cruising Turbine
V Cruising Turbine
W Exhaust From Cruising Turbine to Automatic Closing Valve
X Automatic Closing Valve

Fig. 4.

4 SHAFT ARRANGEMENT OF TURBINE MACHINERY.



A Steam From Boilers
B Main Regulator Valve
C Steam to H P Turbine
D H P Turbine
E Exhaust From H P Turbine to L P Turbine
F L P Turbine
G Exhaust to Condenser
H Condenser
J Air Pumps
K Circulating Pump
L Astern Regulator Valve
M Steam to H P Astern Turbine
N H P Astern Turbine
O Exhaust From H P Astern to L P Astern Turbine
P L P Astern Turbine
Q Regulator Valve to H P Cruising Turbine
R Steam to H P Cruising Turbine
S H P Cruising Turbine
T Exhaust From H P Cruising Turbine to Self Closing Valve
U Self Closing Valve
V I P Cruising Turbine
W Exhaust From I P Cruising Turbine to Self Closing Valve
x Self Closing Valve
Y Direct Steam Regulator Valve to I P Cruising Turbine
Z Direct Steam to I P Cruising Turbine
a Exhaust From H P Cruising Turbine to Self Closing Valve When Engine Rooms Are Independent
b Self Closing Valve

Fig. 5.

jets of moderate velocity, impinges on the moving blades, and imparts to them a rotary motion, this process being repeated on each successive ring of fixed and moving blades throughout the turbine.

As the steam passes from ring to ring, it falls in pressure and increases in volume, and, to meet this expansion, the blades are increased in height by steps. The areas of the steam passage through the blades thus gradually increase from one end of the turbine to the other, to correspond

steam presses aft on the blades and on the annular part of the drum forming the step between the drum and the dummy piston, and the sum of these pressures balances the thrust of the propeller. To meet any unbalanced thrust such as is set up when steam is turned on or off suddenly, and to maintain the true longitudinal alignment of the rotors, a small thrust-block is provided at the forward end of bearing. Where the turbine shaft passes through the casing, steam-packed glands are fitted. These glands consist of a

number of rings, or strips arranged in series, and designed to obtain a gradual rise or fall in pressure from the inner, or steam end, to the outer, or atmospheric end of the gland. Valves are fitted to these glands to regulate the pressures and to ensure against leakage of air inwards. All the main bearings are under oil pressure, and the oil is discharged from the pump at a pressure of from 8 to 10 lb., or at such a pressure as to ensure the efficient lubrication of all bearings.

In the exhaust casing of each of the low pressure turbines a reversing turbine is fitted.

By means of suitable valves, when manœuvring, the low pressures and astern on each side of the vessel, are capable of being worked ahead or astern, as required, independently of the high-pressure turbines (the high-pressure turbines under such conditions running idly in a vacuum). By this arrangement the vessel has all the manœuvring qualities of a twin screw vessel.

In torpedo boats a similar arrangement is adopted, as in the *Turbinia*, *viz.*, three in series (Fig. 4), with one astern on the centre shaft only. This arrangement permits of a reduced weight being obtained, as compared with the high-pressure, and two low-pressures in parallel for equal efficiency.

In very large powers it is desirable to divide the power over four shafts (Fig. 5), thereby increasing the revolutions and reducing the size of the units. The four-shaft arrangement lends itself well to large war vessels, as two complete sets of engines are obtained, *viz.*, one high-pressure and one low-pressure, with condensing plant in each engine-room. A two-shaft arrangement was adopted in the yacht *Narcissus*, which gave very good results; but for powers over 2,500 to 3,000 a two-shaft arrangement entails additional weight.

One of the chief difficulties which had to be contended with in applying the steam turbine to the propulsion of ships arose in connection with the propellers. It is desirable, for obvious reasons, that a turbine for a given efficiency should be designed to run at as high a rate of revolutions as possible, consistent with propeller efficiency. The speed of turbines for land purposes is considerably higher than is permissible for marine purposes, where the speed of rotation is limited by considerations of propeller efficiency. The question of design of propeller and turbine dimensions requires to be considered independently, and also to arrive at the best compromise to meet the conditions required, *i.e.*, as to weight, space, efficiency, and conditions of service. With a view to increasing the revolutions, the diameters of the propellers and pitch ratios are less than is usual in the case of ordinary reciprocating engines, the smaller diameter of propeller necessitating higher ratios of blade surface to disc area than hitherto attempted with ordinary propellers.

In some of the earlier vessels multiple propellers were tried, but subsequent experiments showed that single propellers on each shaft were preferable. The loss of efficiency which has been observed in some of the vessels fitted with multiple propellers appears to have been due partly to interference from the forward screws and partly to cavitation.

Although more light might yet be thrown on the question of high-speed propeller efficiency, a considerable amount of experience has now been obtained with turbine-driven propellers, which enables a close estimate to be made as to the efficiency which might be expected in a given design where reliable data as to H.P. necessary for the proposal in question can be obtained.

On account of the greater range of expansion dealt with in the turbine, as compared with the reciprocating engine, a good vacuum is much more essential in the former than in the latter, and, because of the importance of a high vacuum with the steam turbine, careful consideration requires to be given to the condensing plant.

With a view of maintaining a high vacuum, a new apparatus has been introduced to assist the ordinary airpump and condenser, known as the "vacuum augmentor." The augmentor consists of a small steam jet placed in a contracted portion of a pipe, led from the bottom of the condenser. The jet draws air from the condenser, and delivers it to the airpump through a small auxiliary cooler. By this means the air is reduced to a negligible quantity.

(To be continued.)

Mauretania.—The view of this vessel which we gave in our last issue was from a photograph by Messrs. The Claude Newbald Photographic Company, of South Shields.

ELECTRICITY ON BOARD SHIP.

II.*

By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc.M.I.C.E., &c.

THE CONTINUOUS CURRENT DYNAMO.

IN the early days of electric lighting on board ship, the dynamo was usually run at about 65 volts, this being the pressure that was somewhat popular on shore at that time. It was a convenient pressure to run arc lamps from, for cargo purposes, the ordinary arc lamp taking 50 volts for itself, and requiring another 15 volts, which was wasted in a resistance provided with it, without which the lamps would not work properly under these conditions. Later on, the Admiralty adopted a standard pressure of 80 volts, principally, the writer believes, because it was a convenient pressure for running searchlights from, the arc lamp employed with searchlights taking a higher pressure than the ordinary cargo lamp, and requiring a certain resistance as well. Since then the advance has been made to 100, 105, and 110 volts, and there is no reason that for power work, with the increased length that is being given to every new ship that is built, that 200 or even 500 volts should not be employed, as that will enable the size of the cable to be kept within moderate dimensions.

But for lighting purposes it will be wiser to keep the pressure as low as possible, because the high-pressure incandescent lamps those for 200 to 260 volts that are so commonly used on shore now—take more electricity for a given c.p. than the lower voltage lamps; and, what is more important, they are very much more delicate.

As will be explained later in the articles, the 200-volt filament for any given c.p. is more than twice the length of the 100-volt filament, while it is about half the thickness, and, consequently, is very subject to breakage from the vibration of the main engines and the jerks it must necessarily receive when the ship is knocking about in a seaway, and, in the case of men-of-war, when the big guns are fired.

THE PRINCIPLE OF THE DYNAMO.

The principle upon which dynamo machines, both for generating current and for converting current into motive power, are constructed is, when a conductor crosses a magnetic field, an electrical pressure is created in the conductor, and, if there is a complete path for it, a current flows in obedience to the pressure created. The magnetic field is the space in the immediate neighbourhood of a magnet, in which the force known as magnetism is apparent. With an ordinary bar magnet, the magnetic field is principally in the neighbourhood of the ends of the bar, but traces are to be found, in the case of a powerful magnet, all round the bar and for a certain distance away from it. With a horseshoe steel magnet the magnetic field is confined to the immediate neighbourhood of the two poles, and principally to the space between the poles. Faraday conceived the idea that what he called "lines of force" extended outwards from the poles of a magnet, and that the number of these lines were in proportion to the strength of the magnetic field. An idea of the magnetic field may be formed by the well-known experiment of placing a magnet underneath a sheet of paper or of thin glass, and sprinkling iron filings over the paper or the glass. The filings will be seen to arrange themselves in a particular order, and to be bunched in the neighbourhood of the poles, and, in the case of the horseshoe magnet, to be principally confined to the space between the poles, as mentioned above. The line of magnetic force is now understood to be a definite quantity, and electrical engineers talk of creating a certain number of lines of force, or a certain strength of magnetic field, in a given space. They design their machines to create the given strength of magnetic field and the given number of lines of force, and the results obtained if the design is in accordance with the now well-known principles, agree with the intention of the designer. In the dynamo a magnetic field is created in a cylindrical space enclosed between crescent-shaped pieces of iron, forming part of what are now called the field magnets. In the modern dynamo there are several field magnets and several crescent-shaped pole pieces as they

* First article appeared in our last issue.

are termed, enclosing the cylindrical polar space in which that portion of the machine called the armature, which carries the conductors in which the electrical pressure is to be generated, revolves. The strength of magnetic field obtainable with permanent steel magnets is very limited, and, in addition, it is not constant, the steel gradually losing its magnetism from the moment it is put into service. Forms of permanent steel magnets are now made which retain their magnetism for a long time, but they are only small in size, and are used entirely for some of the measuring instruments that will be described later on. The magnetic field of the dynamo is created in all cases now by electro-magnets. The electro-magnet is a piece of iron round which an insulated wire has been coiled, and it becomes a magnet, similar to the steel magnet, and with the same properties, when a current passes through the coils surrounding it. The number of lines of force created by an electro magnet may be taken to be approximately proportional to the sectional area of the iron core, as it is called, the mass of the iron round which the wire is coiled, and to the strength of the current passing in the magnetising coils. This statement is not strictly accurate, as the number of lines passing through any given piece of iron or steel, and thence into the space dominated by the electro-magnet, increases very rapidly with an increase of current during the early stages of magnetisation, and very slowly as the number of lines of force created reach a certain definite quantity, but it is correct for the degree of magnetic saturation usually employed.

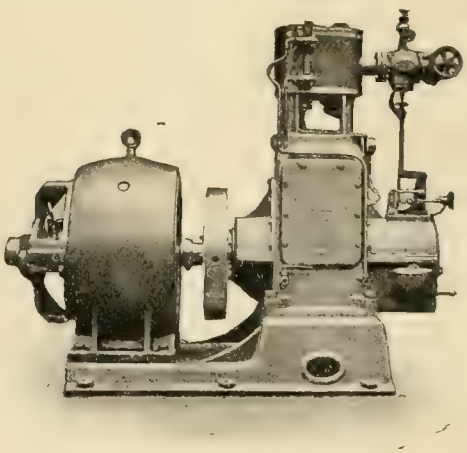
Iron varies in the readiness with which it accepts magnetisation. As electrical engineers express it, all substances offer a certain resistance to the passage of the lines of force through them. Air, the metals (with the exception of iron, nickel, and cobalt), and pretty well every other substance offer approximately the same proportional resistance, which is something like 1,400 times that offered by wrought iron. Nickel and cobalt offer a little less resistance than the other substances; but, for practical purposes, iron or its alloys, cast-iron and steel, are the only metals available for use in the construction of dynamo machines and apparatus where a powerful magnetic field is required. Cast-iron has a little more than twice the resistance of the best wrought-iron. There is not much difference between the various brands of good wrought-iron, and mild steel offers about the same resistance, while a special form of steel that has been produced at Sheffield for some years now, offers practically the same resistance, in some cases even less than the best Swedish wrought-iron, and can be cast into any form that may be desired, greatly facilitating the construction of dynamo machines. In the modern continuous-current dynamo there is a circular enclosing ring from which iron cores of usually circular, but sometimes of eliptical or rectangular section, project radially inwards, each core having a coil of cotton-covered copper wire surrounding it, and having the crescent-shaped pole-pieces mentioned at its inner end, the pole pieces, together with the space between them, enclosing the cylindrical polar space. In this cylindrical space a drum, built up of plates of thin iron or mild steel, or special magnet steel, is suspended upon an axle, the axle running in bearings carried either by pedestals fixed to the bed-plate of the machine, or by brackets supported by the circular enclosing magnet ring. The core-plates of the armature-drum are now always slotted on their peripheries, the slots forming channels in which copper conductors are laid, and a powerful magnetic field, or, rather, a number of separate magnetic fields, are created between the crescent-shaped pole-pieces and the core-plates of the armature drum. The lines of force pass from one of the pole-pieces, say the North seeking pole (that which, if the magnet core and its coil was suspended freely, would turn to the magnetic North), across the small air space intervening between the pole-piece and the iron drum, through the portion of the iron drum interposed between the North pole and its companion South pole next to it, thence across the air space to the South pole, through the iron core of that limb of the electro-magnet, through the portion of the enclosing ring between the two limbs of the electro-magnet, back to the North pole-piece. Between the pole-pieces and the iron drum the lines of force are congregated, passing almost perpendicularly from one to the other, and, when the conductors held in the slots on the iron drum are whirled round by its revolution, they cut the lines of force at right angles, that being the most favourable angle for the purpose.

This will be continued in the next article.

STEAM DYNAMOS FOR SHIP-LIGHTING.

MESSRS. BUMSTED & CHANDLER, Cannock Chase Engine Works, Hednesford, Staffs, have recently turned out a couple of steam dynamos for ship-lighting, the dynamos being made by The India-Rubber and Guttapercha and Telegraph Co., Ltd., of Silvertown, E., the output of each being 12 kilowatts. Each set was run for a four-hours' test on full load at a speed of 650 revolutions per minute. The engine ran quietly that there was no perceptible sound when standing close beside them.

The cylinders of these engines are 7 in. diameter and stroke 4 in. Forced lubrication is supplied to all the moving parts at a pressure of 20 lb. by a valveless pump, the oil being used over and over again. A strainer is fitted in the base of the engine, through which the oil is filtered before it is drawn into the pump. This strainer is held in position by a spring, and it is a work of only four to five seconds to take it out and replace it. The hand-hold and cover are seen at the right-hand end of the engine in the illustration.



The shaft governors are also at this end of the engine, and are completely enclosed by a light cover, the removal of which exposes the governors, oil pump, and crankshaft bearing. This is a special feature, which the makers claim has many advantages, as both main bearings are so easy of access, and the bottom brasses can be quickly taken out without lifting the crankshaft or dismantling any other part of the engine.

The crankshaft is made of a special steel, and is annealed. A test piece is cut from the webs, close to the crank pin. This test piece is subjected to a severe test, by bending it cold to a U shape; if any sign of fracture is then visible the shaft is rejected.

The fly wheel is sandwiched in between the flanges of the dynamo and the engine, and is held and driven by six fitted bolts. This avoids the fitting of keys and the use of the hammer.

The crosshead slipper is circular, and works in a pressure of 15 to 20 lb. of oil over its entire surface, thus metal contact between it and the guide is entirely prevented. This is proved by the fact that the tool marks remain like new after many years of work.

The valves are of the piston type, and are made of

hard cast-iron working in a hard cast-iron bush forced into the cylinder casting, both are thus easily renewed. Pistons are made of steel, and have special provision for preventing the rings from chattering, even at high speeds. All bearings and brasses are adjustable, but the system of forced lubrication renders this necessary only at long intervals.

Messrs. Bumsted & Chandler use metallic packing of their own make, which is perfectly steam tight, and as frictionless and durable as it is possible for any packing to be. The firm has turned out a large number of engines similar to the illustration—both single-acting and double-acting. There are considerably over 1,000 at work on board ships.

INSTITUTE OF MARINE ENGINEERS.

Sixteenth Annual Dinner.

THE sixteenth annual dinner of the Institute of Marine Engineers was held at the King's Hall, Holborn Restaurant, on Wednesday evening, October 3rd, when about 300 were present. The President, Lord Pirrie, was in the chair, and was supported by Sir Fortescue Flannery (Past President), Sir William White (Past President), Sir William Arbucke (Agent-General of Natal), Sir Alexander Binnie (President, Institute of Civil Engineers), Mr. Henniker Heaton, M.P., Messrs. A. Beldam and G. W. Manuel (Past Presidents), Sir John Durston (Past President), Sir John Glover (Chairman of Lloyd's Register), Sir Charles Scotter (Chairman, London and South Western Railway), Mr. William Watson (Chairman of Cunard Line), Dr. R. T. Glazebrook (National Physical Laboratory), Mr. J. T. Milton (Engineer-in-Chief, Lloyd's Register), Mr. Henry N. Malan (Registrar-General of Seamen), Alderman Bothwell (Mayor of West Ham), Mr. Walter J. Howell, C.B., Messrs. Henry Leask, F. N. Piggott, Sidney Paterson, F. D. Green, R. L. Forbes (Secretary, Royal Mail S.P. Co.), H. J. Cornish (Chief Surveyor, Lloyd's Register), Andrew Scott (Secretary, Lloyd's Register), Messrs. A. Boyle and Robert Leslie (Vice-Presidents); the office-bearers and members of Council were all present; Captain A. J. Chalmers (Marine Department Board of Trade), Mr. T. A. Coghlan (Agent-General of New South Wales).

Mr. William I. Taylor was convener of the committee of arrangements.

After the loyal toasts,

Sir Fortescue Flannery proposed "The Imperial Forces." He said he was compelled to remind them that the greatest of British interests was peace, and peace could not be better preserved than by preparedness for war. He could imagine no danger so great as Britain's if her preparations for war were relaxed. The country recognised this more and more every year. The Navy was a protection not only against invasion, but a protection of the line of communication which brought food to this country. As to the *personnel* of the Navy, engineers were quite satisfied. In Parliament he had pressed for greater recognition of the engineers in the Navy, and on looking back they had much to be thankful for. The *personnel* of the fleet was as perfect as they could expect.

Engineer-Captain R. W. Edwards, R.N., who replied, said the Army and Navy only existed for the defence of the Empire, and their objects were the same. He had always found the utmost co-operation between the two forces. The toast was not complete without including the mercantile marine. Changes in the Navy were due to the marine engineers, and it took the Navy all their time to keep up to date. In the old days the Britishers were the best seamen, but engineering science had put all nations more on a level. They must insist that the Navy was well trained, or good-bye to its supremacy.

Mr. Manuel also responded, and said the Volunteers and Reserve Forces, when treated well and not too much interfered with, would do very good work.

The toast of "The Institute of Marine Engineers" was submitted by Sir John Glover, who said he was not an engineer, and how could they expect him to talk about engineers? He had been an employer of marine engineers for about forty years, and he could not refuse to testify to their general competence, the increasing value of their services, and the value of an institution designed solely for their improvement and encouragement. The more so when he found it was a splendid illustration of self-help. It was important that engineers should be educated, courageous, and resourceful. This Institution would develop self-help and encourage all engineers to do the same. He coupled with the toast the name of Mr. James Adamson, the hon. secretary.

Mr. Adamson said: In rising to return thanks for the way in which the toast of "The Institute of Marine Engineers" has been received, I feel happy in realising that the toast is no less popular now than on former occasions similar to this. There are two essentials which contribute to the successful rendering of even a good toast—the appreciation of the one proposing and the appreciation of the audience receiving it. These two essentials have met to-night to a degree which renders the result most gratifying, and gives to the responder a duty of a doubly pleasant nature. An enthusiast sometimes degenerates into a faddist, and a faddist into a bore, so that one on the top plane has to beware lest he fall by want of tact and of judgment into the stage below. The responder to this toast has been called an enthusiast, and possibly evidence is not lacking to prove the case. He hopes to remain on the upper plane, and at this our annual gathering would seek to enlist the sympathy and help of everyone present, and kindle anew some enthusiasm for the progressive advancement of the Institute. May he, therefore, trespass upon your patience to direct your attention to the desire the office-bearers and council have to increase the value and importance of the Institute to, and in, the esteem of every member of whatever grade. There is ample opportunity, as pointed out by Sir William White at our last year's dinner, to increase the membership; there is no less opportunity to increase its usefulness by each one contributing to one or other of the various sub-divisions of the work. The transactions are now being issued monthly, and from the letters and comments which have reached me, this arrangement has been hailed as an improvement. It is compensation to know that the extra work involved has been appreciated, and as this work has fallen mainly on the advocate of the change, the compensation is balanced; and, further, several of the letters and comments having come from the members abroad, these are all the more satisfactory. Our visits to works during the summer have been productive of good, an assurance which those upon whom the labour of arranging and carrying them out has devolved are glad to know. Another suggestive thought occurs, and which I would urge upon you—that the membership should keep pace with the passing years, and on the attainment of the majority the numbers should be in the hundreds for the twenty-one years of life. I do not wish to anticipate the toast which follows, but there is one guest present to-night, whom I cannot but refer to with pleasure—the Chairman of the Cunard Company—whose spirit of enterprise and patriotism has brought forth the building of magnificent steamers to compete with those now bearing the palm for the Atlantic. May success crown the effort and Britain once more regain the supremacy. Surely when the Chairman of Lloyd's Register of British and Foreign Shipping, than whom a more honourable and important safeguarding commercial body with the mantle of years around it does not exist, proposes the toast, we may consider the Institute of Marine Engineers has passed into the classification book, the secretary and the two surveyors-in-chief being witnesses. Gentlemen, ere resuming my seat I would add a word more, and seek to inspire every engineer to do what he can to maintain the dignity of his calling, to foster the best instincts of his mind and heart, and encourage, as far as possible, in his own particular way, the progress of the Institute in all that is true and good, so that we may esteem it and have a proud satisfaction in its welfare.

Mr. W. C. Roberts (Chairman of Council), proposed the health of "Our Guests."

Sir Alexander Binnie, in reply, spoke of the way marine engineers promoted the peace of the world by bringing distant nations nearer each other.

Mr. William Watson (Chairman, Cunard Company), who also responded, said he sometimes asked what became of the young men who were apprenticed on the Clyde. Some of them went on the steamers across the ocean, and they could not have a finer body of Englishmen or Scotchmen than they were. Then there were those with the inventive genius of the marine engineer. There was no finality to their inventive genius. The shipowners did not know when it was to

stop, and the marine engineers cost them more every year.

Mr. Alexander Boyle (Vice-President), in toasting "The President," said that the engineers all felt honoured when they learned that his Lordship had been selected by his Majesty for national honours. They looked on Lord Pirrie as one who had worked his way up from the beginning. He had served his apprenticeship for five years, and in his youth and early manhood was a "six o'clock in the morning man." That was worth knowing to those who wanted a short cut to engineering success.

The President said that he felt the greatest pleasure, and that it was one of the greatest gratifications ever conferred on him when their Council and officers asked him to accept the position of President. He was following in the footsteps of great engineers and scientific men, and he felt a gratification that he was thought worthy to occupy that position. He thought it should be the aim of every young man, whatever his position in life, or whatever his profession, that he should try to get to the highest position he could attain. When he started in 1862 he saw before him a dark horizon, but he was determined to get to the other side. He then had no special ability for engineering. He started on the Clyde, and afterwards came to London. Marine engineers were now looking to civil engineers to make them better harbours and larger docks. It was the duty of the marine engineers to point out to civil engineers what they would want forty years hence. He thought their Council and the Committee, who had a great deal to do to carry out the details of that gathering, deserved credit for the success of the evening. The speech he intended to make was still in his pocket, and was no use, because so many gentlemen had taken a little bit off it. They found him as an Irishman trying to get out of a difficult position as well as he possibly could. It might be asked why he had not built the largest ship in the world. That had gone away from him, but he envied its builders. He appreciated the courage and, if he might use an Irish word, the pluck of the Cunard Company in having such a steamer. But the young men, and even those as old as himself, could look forward to greater development in engineering in the future.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

THERE has recently been published some particulars of an electrical system of hauling canal boats, adopted in Germany, because of the damage to the banks caused by steam tugs. To make the scheme successful, however, there must be a large number of barges to be towed; but in this case the matter was further complicated by the fact that the canal had two long stretches of lake in the course. Locomotives are employed for the canal proper, driven by overhead trolley, and track laid down along the banks for this purpose. The speed of the barges when drawn by the locomotives is 2½ miles per hour, the load being two barges of 600 tons capacity each. For crossing the lakes, a tug is used. Three screws are employed, and the vessel is divided into six compartments, the two end ones being used for trimming the boat, while the second, third, and fifth contain a battery of 229 cells of 244 ampère-hour capacity, at a five-hour rate of discharge, the total weight of the battery being eleven tons, the charging of which was effected from the overhead trolley line. In the fourth space are three series-wound motors, the middle one with a capacity of 25 H.P., and the two outer ones with 20 H.P. The drive is direct, without intermediate gearing, and the speed is, therefore, high, varying between 202 and 536 revolutions per minute, for pressures between 120 and 415 volts on the motors. To avoid damage to the banks, the screws are placed low. The circuits are arranged so that the motors may be driven from either the accumulators or from the overhead line. The trolley arms for the tug are necessarily peculiar, as they have to pivot round a central mast. The accumulator-driving was found to be quite satisfactory, but with the trolley-driving, the risk of running off the line was too great. As to the question of efficiency, it was found that at 2½ miles per hour the current consumption is about 14·4 watt-hours per ton mile, with a working efficiency of the screws of 22 per cent.; and this consumption is about three times as great as for the locomotive doing the same work. As regards management, the length of the canal is divided into sections, and some of the locomotives cross by bridges, and haul back on the other side. Drivers, too, change over, some of the sections being as much as seventeen miles long. The whole installation is of an interesting character, on account of the difficult conditions to be surmounted; but, as we said at the outset, there must be a considerable traffic, and in this case this has been obtained by a law passed that all barges on the canal must be hauled by the one administration. This, therefore, with the economy obtained, makes it successful.

The question of flame arc lamps is a matter of some interest at the present time, as a great deal of ingenuity has been expended in this direction, with a view to obtaining more light. Generally the system adopted is to impregnate the carbon with metallic salts; but this has been done at the expense of the life of the electrodes. The colour is obtained by the nature of the salts employed; but the calcium compounds have given the best results, the carbons producing yellow light being the best for outdoor illumination. For indoor purposes, however, this colour is objectionable. Under its rays, white material appears cream-coloured, and shades of dark blue appear all the same, and black. With white-flame carbons, on the other hand, colours have approximately their daylight value. The distribution of the flame arc lamp is quite different from the enclosed arc lamp. In the former, the light is thrown downward in a zone from 30 deg. to 90 deg. below the horizontal, and sends its rays with equal brilliancy through all the angles, from 30 deg. to 75 deg. below the horizontal, but gives a comparatively small proportion of its light between 0 deg. and 15 deg. below the horizontal. In the enclosed arc lamp, on the other hand, the horizontal illumination is relatively very large, and at 15 deg. below the horizontal the figure is not far from the maximum. The effect of the extreme luminosity of the flame lamp downwards has its objections for outdoor lighting, because the light around the pole is out of all proportion to that at moderate distances away from this position. At a distance of 7 ft. from the pole, the figures are 10 to 1 in favour of the flame lamp, and at 115 ft. 2·8 to 1. To place the lamp higher above the ground, and utilise its advantages, presents difficulties, and hence some form of reflector is said to be necessary to spread the rays horizontally; but up to the present this has not been found.

A launch has been specially designed for the Liverpool Corporation, for use on Lake Vyrnwy. This launch has to tow barges, as well as convey workmen, and is of an overall length of 31 ft., an extreme beam of 6 ft. 8 in., with a draught of 2 ft. 3 in. The hull is carvel-built, of Kauri pine, with frame and main timbers of English oak. A turtle-back forward enables the boat to be used in heavy weather, and a deep combing affords protection from spray. There is seating accommodation for twenty-five persons. The motor, fitted amidships, is of the bipolar under type, specially designed for marine work, and develops 6 B.H.P., at a pressure of 150 volts. The controller is placed alongside the steering-wheel, together with an ammeter and voltmeter, by means of which current and voltage when running are under the observation of the man in charge. Motive power is derived from the eighty-eight accumulators carried in lockers under the seats, the total mileage capacity being 45 miles at full speed. A flexible shore cable carries the current from a special charging station on shore at a pressure of 235 volts, the daily compensation water flowing into the River Vyrnwy being utilised for lighting and power purposes. At the trials a speed of 7·75 miles per hour was obtained, this being three-quarters of a mile in excess of the contract. The designers were Messrs. F. H. Smith & Co., of Liverpool.

We referred, in our description of the Olympia Exhibition, to a slotting machine by Messrs. Stirk & Co., of Halifax. This is a 6-in. one, with the motor embedded in the upright body of the machine itself. This motor is rated at 1½ H.P., at any speed from 500 to 1,500 revolutions per minute. The first transmission is by a chain inside the hollow upright to the pinion shaft, further reduction being by the usual gearing at the back of the machine.

Messrs. J. H. Holmes & Co.—The well-known firm of Messrs. J. H. Holmes & Co., of Portland-road, Newcastle-on-Tyne, have issued a new edition of "Electric Light and Power Installations Illustrated," which contains photographic representations and descriptive particulars of the number of contracts carried out by them. This catalogue contains nearly 100 pages, and its get-up is of quite an artistic character. The various illustrations indicate clearly the extensive application of electricity carried out by the firm.

ENGINEERING EXHIBITION.

THE patrons of the Engineering Exhibition dined at Olympia on Saturday, October 6th, presided over by Sir William H. White, when there was a large and representative gathering. The Institute of Marine Engineers was represented by two past-presidents (Sir W. H. White and Mr. A. Beldam); Messrs. W. C. Roberts (Chairman of Council), A. E. Battle (member), and James Adamson, Hon. Sec.

After the loyal toasts had been submitted by the Chairman, and honoured in the usual way, "The Navy, Army, and Reserve Forces," was proposed by Sir G. Bartley, who said that, in searching for a reason why he should have been chosen to propose such a toast, he concluded that, being a man of peace, he had been suggested, with the idea that, realising the value of peace, he could heartily express the thought that the best way to preserve peace was to be fully prepared for war—a state he was assured the forces named in the toast were in, to meet not only one, but two or even more combinations which might arise. He coupled with the toast the names of Admiral Eardley Wilmot and Colonel Sir E. Raban, R.E., who duly responded.

Sir Edwin Cornwall, M.P., proposed "Success to the Engineering Industry, and Continued Success to the Engineering and Machinery Exhibition," and stated that the success of the Exhibition was undoubted; and he was sure that the visitors would bear him out in that statement. Their chairman was one who had largely contributed to its success, and he coupled the toast with his name.

Sir William White, in responding, said that they had met on the day of the opening of the Exhibition, hoping that it would be a success. Now they could see the fruit, they were pleased to witness their hopes had been crowned with success. Among others who had written expressing regret at inability to attend that evening was Sir John Durston, who, in his letter, said that he had been glad to see so many mechanics and foremen of works visiting the Exhibition; it showed they were eager to see the tools and appliances which others were using, so that they might gain suggestions for their own work.

Dr. Glazebrook proposed "The Rising Generation of Engineers," to whom would be entrusted the future plans and inventions which were being developed; and he coupled the toast with the name of one who had the educational training of young engineers Professor Perry, who, in responding, said that an engineer was one who could devise a means of carrying out what the general public would consider almost impossible.

Mr. Worthington, in proposing "The Patrons and Visitors," referred to the co-operation of the various engineering societies, their presidents, past-presidents, and secretaries, in furthering the arrangements of the Exhibition. Thanks were also due to the gentlemen who had given, or were still to give, papers and lectures during the time the Exhibition remained open. He had pleasure in according thanks to the Hon. C. A. Parsons and Mr. Walker, to Professor Hele-Shaw, and others, for their help in this way. Messrs. Smith and Professor Unwin responded.

The Hon. J. G. Jenkins (Agent General for South Australia) said, in responding for "The Colonies," although not an engineer, in the sense of trade, he was engineer in politics and commerce; he thought the Exhibition was likely to do good, and hoped that more and more the Home Country and the Colonies would work together for mutual advantage, each giving to the other what was lacking, and the best that could be supplied to suit their several wants.

The health of "The Chairman" was then given with heartiness, and as heartily received. Sir William White returned thanks, when the proceedings closed with "God Save the King."

It was remarked in the course of the evening that the presence of no fewer than five representatives of the Colonies was a feature most pleasing and satisfactory to all.

To Messrs. Smith and Bridges are due the inception and active carrying out of the arrangements for the Engineering Exhibition, and it must be to them, as well as to the President and Members of Committee, a source of gratification that it has proved a sucess, from the various points of view of exhibitors, visitors, and organisers, thus giving benefit to trade and commerce, to those seeking instruction, and to charitable institutions, which will receive bequests according to the balance which will remain after the expenses have been met.

THE SCREW PROPELLER CONTROVERSY.

(*Continued from page* 52.)

MR. McFARLANE GRAY said much more than was reported in the Transactions, but as much was of an irrelevant character he (Mr. McFarlane Gray) evidently thought it better to leave it out. As he had taken the opportunity of printing, by permission of the Institution of Naval Architects, a full copy of the discussion of his 1890 paper, and had sent copies to the Secretary for distribution among the members, it would be seen by all who read it how far Mr. Luke was correct or otherwise in charging him with having given a false impression of that discussion. Mr. Luke continued by asserting his (Mr. Howden's) ignorance of the laws of motion, and of, in short, everything regarding the proper understanding of the screw, and that his paper was a mere mass of dogmatic assertions based on general ignorance. So much was Mr. Luke impressed with the extreme worthlessness of his paper that he could not conceive how any scientific institution could accept such a paper consisting only of ideas which were exploded some fifteen or sixteen years ago, if not before, a paper which would injure the Institution by being published in its Transactions. Possessing the common feelings of human nature, he confessed that such extraordinary personal denunciation in a meeting of this Institution was what he was quite unprepared for. In discussions at such meetings, more especially where scientific subjects were treated, even when much difference of opinion existed, one at least looked for courtesy not being entirely absent. When a striking departure from the usual amenities unexpectedly occurred, it was difficult for one to quickly adjust one's mind to the new and unpleasant situation. While Mr. Luke was summing up the enormity of his offences, he (Mr. Howden) seemed to lose his identity, and he no longer in the Institution in which in his youth he spent many a profitable and happy hour, but was now some other person in a court of justice under trial for some heinous offence, with a public prosecutor, zealous for the interests of the community, vehemently enumerating the crimes of the accused. The denunciation of the Committee on Papers must have partially recalled him to his senses, as he then felt that nothing less than expulsion from the Institution would expiate the enormity of his offences. It was difficult for him to understand why his paper had caused Mr. Luke to make such condemnatory remarks; but, perhaps, his early training had led him to consider that his (Mr. Howden's) reference to the writings and formulæ of certain writers on the Screw Propeller (who were doubtless regarded by Mr. Luke as the highest authorities on the subject) as being "founded on erroneous assumptions and without any scientific basis," was outrageous. If such were the case, it would not matter to Mr. Luke whether he gave an unassailable geometrical proof of the correctness of his statements or not; no geometry or argument would convince him, or those equally prejudiced, that he could be anything else than wrong. He was, therefore, not long in regarding Mr. Luke's criticism with absolute equanimity of mind. There was, he granted, a certain virtue attached to blind devotion to authority, but he ventured to submit that geometrical and mechanical questions could not be solved by simple denunciations. He hoped, however, that Mr. Luke would yet apply his evident abilities to an unprejudiced study of his paper, which, if he did, he guaranteed he would come to conclusions regarding it quite the reverse of those he lately so forcibly expressed. The only other member who took part in the discussion of February last, who remained to be noticed, was Mr. E. Hall-Brown, who, after putting himself in line with the other speakers by stating that he absolutely disagreed with his theories (keeping like others, the cause and nature of these disagreements carefully concealed), as Convener of the Committee on Papers, offered a somewhat faint protest against Mr. Luke's censure of the Committee for allowing his paper to be read. He excused the forbearance of the Committee on the ground of his long connection with the Institution, and the fact that his paper would at least serve the purpose of sending the young men of the Institution back to the literature on the subject to study the writings of Rankine, Froude, and Greenhill, for themselves, and thereby eventually save the Institution from harm. This idea of saving the young men and the Institution from being damaged by his paper (the older members, like him-

self, being damage proof) struck him as so good that he, for one, felt ready to assist in this endeavour. He trusted the Council would approve and accept, even from so dangerous a member of the Institution as himself, the offer he (Mr. Howden) now made of £50 as a prize to any young member who would, on the judgment of two competent neutral experts, one to be chosen by the Institution and the other by himself, prove geometrically and quantitatively the erroneousness of his views on the action of the propeller, and at the same time the correctness of the theories of Rankine, Froude, Greenhill, or others, who held views opposed to his. An interesting communication from a member of the Institution, Mr. Matthey, residing at Kiev, was sent to him by the Secretary while he was engaged with the replies to the members who took part in the discussion on his paper in February. Frequent absences from town prevented him from reading Mr. Matthey's communication until he had completed these replies. This communication was marked by much ability, and was written in a fair and scientific spirit; yet, somehow, Mr. Matthey had from the outset missed his argument and mistook his demonstrations, and thus having got upon the wrong track had continued to follow it throughout the whole of his argument. Mr. Matthey began by stating "that there was no difference between Mr. Howden and Rankine as to the motion of the water in the immediate neighbourhood of the propeller blade, though they differed in the deductions they drew from that motion." This remark gave the key to the whole of Mr. Matthey's subsequent treatment of the subject and the mistaken conclusions at which he arrived. As he (Mr. Howden) had already used a large part of his reply in controverting this mistaken idea that his view of the motion of the water by the blade was in any way like that arrived at by Professor Rankine, he must refer Mr. Matthey to what he had already written to show that he (Mr. Matthey) was mistaken in the conclusions quoted. Mr. Matthey had given himself much trouble in working out the motions imparted to the water over the whole surface of the blades on the view assumed by Professor Rankine, as if such motions actually existed. If he had proved anything by his demonstrations, it had been that no such motions existed. It, therefore, became a mere waste of time to make up such diagrams and calculations as Mr. Matthey had done in order to ascertain the thrust and I.H.P. of the propeller. He had already shown that the only agreement between Professor Rankine and himself on this subject was that the slip of the water at any given diameter was less than the slip of the screw per revolution in the proportion of DE to DC in Fig. 2 of his paper. Beyond this single point there was a complete difference. In the case of the example propeller at 10 per cent. slip, Professor Rankine added the whole slip of the water per revolution to an imaginary cylindrical column 25 ft. long by 20 ft. diameter, in order to obtain a reaction or thrust from the movement of this mass in one second and by one impulse, a distance equal to the total slip of the water on the revolution. On the other hand, he proved that, instead of this 27 in. or so of slip movement of water being given to this imaginary column of about 27·24 ft. in length, there was no such column in existence, and that the movement of water by slip, normal to the face of the blade was, at 20 ft. diameter of this propeller, only ·82 in., which was ascertained by dividing the length of the line DE of Fig. 2 by the number of times the breadth of the blade was contained in the line AD, which, at the extreme diameter, was a thirty-seventh part of DE. Fig. 4 of his paper showed to scale the actual movement of water at 10 per cent. slip with this screw at 12 ft. 6 in. diameter, where the blade was much broader and the distance travelled per revolution much smaller than at 20 ft. diameter. Mr. Matthey, in his calculations, used the resultant of the components of the tangential and sternward movement of the slip in order to calculate the thrust and I.H.P. on Professor Rankine's lines, and consequently reduced the extent of the movement from that used by him, which was simply the movement of the water by slip normal to the face of the blade. If the great movement of the water by slip, on which Professor Rankine based his formula, actually existed, and if it were possible to make the formula $\frac{W}{g}$ applicable (both which suppositions, he said, were incorrect), then Mr. Matthey's mode would give more exactly the thrust and power for any individual percentage of slip, but would not exhibit more exactly the error of the whole formula, as proved, when applied to different percentages of slip, which latter was the principal object he had in view in demonstrating the radical erroneousness of Professor Rankine's theory. This would be more easily understood by pointing out that Mr. Matthey made the *thrust* I.H.P. by his application of the Rankine formula at 10 per cent. slip as 1,360, while by his mode of applying the formula it was 1,635 I.H.P. If calculated on both modes, say, for 5 per cent. slip, the I.H.P. would in each case be nearly one-half of these respective powers, and similarly, if applied to 20 per cent. slip, the I.H.P. would be nearly doubled in both cases. The point of his argument was to show the radical error of the formula in being based on erroneous assumptions, and in making the thrust nearly proportional to the slip, as he had before so fully explained. He had no further time at his disposal to take up every point Mr. Matthey referred to, but most of his questions, he trusted, he (Mr. Matthey) would find answered in his reply to similar points which emerged in the discussion. To these he added the following:—The acceleration of the water by the action of the propeller, referred to by Mr. Matthey in connection with Figs. 18 and 19, was actually so infinitesimal (being thirty-seven times less in quantity and thirty-seven times less in velocity at the extremity of the blade to that assumed by Mr. Matthey and Professor Rankine), that it was unnoticeable, and was quite lost among the other movements. The displacement of the blades much more than neutralised this acceleration. It, therefore, did not and could not affect the water levels or currents before or abaft the screw. It was only when the slip was abnormally large, say, 70 per cent. or upwards, that this acceleration could become a matter for consideration. In the case of 100 per cent. slip, with the ship's stem tied against a quay wall and the engines running at normal speed, the whole engine power would be employed in sending the water astern by the screw blades, and would induce a large current from forward towards the screw. This current assisted the engines in turning the screw. The expression, water passing "into and through the screw," used by Mr. Froude and others erroneously when the screw was at work under ordinary percentages of slip, would then be permissible under these conditions, as the screw would have no forward movement in itself. It would, however, then be no longer acting as a screw but as an immersed wheel, with floats of varying obliquity, set angularly to its axis. Mr. Matthey went so far as to calculate the thrust and I.H.P. of the propeller of his paper on this percentage of slip, using the Rankine formula. The result was that the formula gave a thrust and power that no ordinary proportions of thrust block or engines could bear. It would have been supposed that this conclusive proof of the erroneousness of the Rankine theory would have led Mr. Matthey to discard it, but it did not, nor did he use Proposition 6 of his paper to assist him in solving his difficulties, but used BG of Fig. 14 as the movement of the water given by the blade at 100 per cent. slip. Fig 23 showed the actual slip given by the screw of his paper at 100 per cent. at its extreme diameter. Mr. Matthey's BG and his DE at this diameter was 25·3 ft. The actual movement of the water, as shown by his analysis at this slip (100 per cent.), with 22 in. as breadth of blade, was barely 9 in. The AB, and also AD, of Fig. 23, was

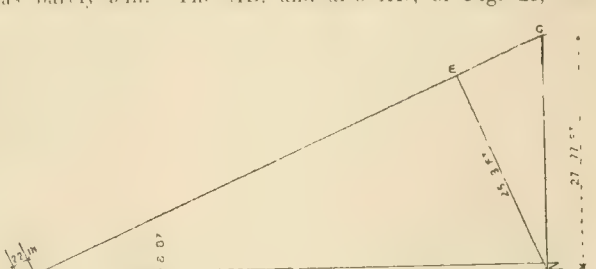


Fig 23

62·8 ft., and the number of times the breadth of the blades was contained in AD was 34·2, and 25·3 ft., or DE divided by this number was 8·87 in. If Mr. Matthey had studied his paper sufficiently he would no longer have felt it so mysterious that a screw might work at a slip of 100 per cent. on the same power and revolutions of engines as when working at 5 per cent. slip, the thrusts being equal. With some forms of blades and pitch ratios, the revolutions

would be less at 100 per cent. slip with the same power than when at full speed at sea, and with other forms more. It was the same with paddle-wheels, the revolutions might be more or less under these percentages of slip. This was dependent on the number, area, and immersion of the paddles. The other points about which Mr. Matthey enquired were misunderstandings on his part, and were explained in the paper. He closed with a misapprehension. He (Mr. Howden) *did* attribute the thrust to the inertia of the water, and to the fact that the reaction was obtained by the blade passing over new fields of water so quickly that no time was given to set up almost any motion by the face of the blade. As he had already expressed it, that owing to the velocity of the blade, it ran, as it were, over helically inclined planes of metal, so little did the water yield to the instantaneous pressure. He might be allowed to express, in closing this long argument, the conviction which he had always felt that if Professor Rankine and Dr. William Froude had been spared in life until after he completed his paper on "The Review of Professor Rankine's Theory," in 1879, they would have been the first to acknowledge the correctness of his demonstrations of the true action of the screw propeller. These were great men, as their works abundantly showed, men who had made those engaged in engineering and naval science and practice all over the world their debtors. They were men having the true scientific spirit which recognised truth from whatever quarter it came. He had not come much into personal contact with Professor Rankine, but his grand manner, enhanced by his fine personal appearance, made him, as he regularly attended the meetings of the Institution, a never-failing object of admiration to him (Mr. Howden). The patient and courteous manner with which he gave explanations of questions, made by the most unenlightened of the members, young or old, was so admirable to witness that he should never cease to remember it with pleasure. Professor Rankine, besides being twice President, attended almost every meeting, and was constantly appealed to on all kinds of subjects, and never failed to respond. He was the Nestor of the Institution. Dr. William Froude, he never met personally, though he had indirect communications with him. In 1878, after he had written his paper of that year, he was invited by Sir James Wright (then Chief of the Admiralty Engineering Staff), to see him on the matter of new screws for the *Iris*. He called to see him on the subject when in London. Sir James was very desirous that he should go to Torquay and see Dr. Froude, with whom he had been in communication on the matter. He was very desirous to go, but some very pressing business prevented him from going at that time. The smaller screws with which the *Iris* made her successful trial were then far advanced, and were to be tried in a few weeks after his interview with Sir James Wright, so that the making of further screws was to be deferred until after this new trial. As was well known, the results were considered sufficiently good to obviate the necessity of making other screws. Some months after this trial, he received from Dr. Froude copies of his last two papers read before the Institution of Naval Architects bearing his own inscription, which were sent to him through the late Mr. William Denny, who, in forwarding them, explained that he did so at Dr. Froude's request. Very shortly after this Dr. Froude sailed for South Africa, in December, 1878, and with universal regret died the following May near Capetown. He had never ceased to regret losing the opportunity of making Dr. Froude's personal acquaintance.

The President said he had at one time been vain enough to think that there was no man in the British Isles who knew more about screw propulsion than himself; but, after thirty years' experience, he had come to the conclusion that he knew nothing about screw propulsion, and he believed that the man had yet to be born who would be able to pose as an absolute authority on that subject. The members should feel indebted to Mr. Howden for the paper which he had given, and he asked them to give Mr. Howden their heartiest vote of thanks for the interesting manner in which the matter had been placed before them.

The vote of thanks was carried by acclamation.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from September 22nd to October 24th, 1906:—

Engineer-Commanders.—J. W. Agnew, to the *Hannibal*, on commissioning, to date October 20th; L. Backler, to the *Hamillies*, to date November 6th; G. T. Kerswell has been placed on the Retired List, to date October 4th; A. F. Kingsworth, to the *Africa*, to date November 6th; W. J. Maudling has been placed on the Retired List with the rank of Engineer-Captain; G. H. Morris, to the *Magnificent*, on recommissioning, to date November 6th; T. C. Morris, to the *Hebe*, on recommissioning, to date October 13th.

Engineer-Lieutenants.—J. N. Allenby, to the *Prince George*; R. W. B. Andrews, to the *President*, additional, to assist Engineer-Overseer in inspection of gun mountings at Elswick, to date October 2nd; F. M. Attwood, to the *Africa*, on commissioning; F. Barter, lent to the *Victory*, for oil fuel course, to date October 2nd; C. H. A. Birmingham, to the *Blake*, additional, for the *Racehorse*, undated; J. A. W. Bourneville, to the *Blake*, for the *Leopard*; F. A. Chater, to the *Hamillies*, on recommissioning; T. W. Cleave, to the *Sapphire*, additional, for the *Ostrich*, undated; J. D. W. H. F. Cranley, to the *Sapphire*, for the *Quail*, to date October 1st; A. S. Crisp, to be Engineer's Commander, with seniority of September 24th, and re-appointed to the *Pathfinder*; H. F. Daves to the *Sapphire*, additional, for the *Syren*, undated; F. E. Dean, to the *Highflyer*, on completing, to date November 6th; G. H. Fletcher, to the *Europa*, to date September 20th; H. L. Giles, lent to the *Victory*, for oil fuel course, to date October 2nd; F. R. Goodwin, to the *Sapphire*, for the *Griffin*, to date October 15th; R. D. Harvey, to the *Highflyer*, on completing, to date November 6th; J. E. Haves, to the *Highflyer*, on completing, to date November 6th; W. G. Heppel, to the *President*, additional, as Engineer-Overseer at Coventry Ordnance Works; A. E. Hyne, to the *President*, as Instructor and Lecturer at the R. N. College, Greenwich, to date October 1st; A. R. Kempt, to the *Africa*, on commissioning; R. A. Lee, to the *Pembroke*, additional, for the *Shannon*; J. Legate, to the *Victory*, for oil fuel course, to date October 2nd; W. E. Longland, to the *Goldfinch*, to date October 5th; J. S. Madden, to the *Euryalus*, to date October 13th; J. S. Massey, to the *Diana*, on recommissioning; J. C. Matters, to the *Vivid*, for the *Hannibal*, to date October 10th, and on recommissioning, to date October 20th; W. McGregor, has been placed on the Retired List, to date September 12th; R. B. Morison, lent to the *Victory*, for oil fuel course, to date October 2nd; J. Mountifield, to the *Diana*, on recommissioning; G. C. Nicolson, to the *Leander*, for the *Lively*; G. C. Nicolson, to the *Pembroke*, for the *Lively*, to date October 15th; A. Oliver, advanced to the Senior List, with seniority of October 1st; H. F. Pocock, to the *Fox*, for the *Paton*, to date October 16th; C. J. Randall, to the *Formidable*, to date October 3rd; A. T. P. Read, to the *Vivid*, for the *Leven*, to date October 10th; S. Rider has been promoted to the rank of Engineer-Commander and re-appointed to the *Vivid*, additional, as assistant to Engineer Manager at Devonport, to date October 13th; F. L. Robertson, to the *Dreadnought*, to date October 17th; E. J. Rosevere, to the *President*, for service in Controllers' Department; J. J. Sargent, to the *Hogue*, to date September 29th; J. W. J. Sellex, to the *Magnificent*, on recommissioning, to date November 6th; E. S. Silk has been promoted to the rank of Engineer-Commander, with seniority of October 8th, and re-appointed to the *Pyramus*, to date October 8th; W. P. Siltince, to the *President*, as Engineer-Inspector; A. M. Underhill, to the *Surprise*; G. H. Vincent, to the *Leander*, for the *Thrasher*, to date October 1st; J. B. Wilshin, to the *Hecla*, additional, for the *Flirt*, to date October 15th.

Engineer Sub-Lieutenants.—P. W. Allen, to the *Good Hope**; R. H. M. Bury, to the *Britannia**; W. A. Carlisle, to the *Antrim**; S. W. Cooke, to the *Africa*, to date November 6th; C. B. Erington, to the *Roxburgh**; R. C. Grigg, to the *Dreadnought*, lent for training, to date October 17th; H. G. W. Haddy has been promoted to the rank of Engineer-Lieutenant in His Majesty's Fleet; R. M. Jones to the *Prince George**; W. V. Kennaway, to the *Magnificent**; P. King, to the *Commonwealth**; A. H. Parry to the *Duncan**; F. H. Pratt, to the *Devonshire**; W. G. Radmore, to the *Hampshire**; E. G. Sanders, to the *Argyll**; T. Spalding, to the *Jupiter**; J. D. Sturrock, to the *Cæsar**.

Acting-Engineer Sub-Lieutenant.—J. W. Phillips has been confirmed in the rank of Engineer Sub-Lieutenant in his Majesty's Fleet.

Artificer-Engineers.—D. E. B. Morley and J. T. Nance, to the *Victory*, for oil fuel course, lent, to date October 2nd.

* All lent, additional, for training, and all to date October 11th.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

THE strike of the Boilermaking and Iron Shipbuilding section of the Clyde shipyard workers for a rise in wages still continues, proposals for, and attempts at, mediation by third parties having been of no avail. A conference between the Employers' Federation and workmen's delegates, from which much was hoped in the way of improved attitude, if not of definite compromise and satisfactory settlement, which was held on the 24th and 25th ult., has left the situation much as it has been at any time these past four weeks. On the main point—that of an advance of wages—the employers simply re-stated their previous position. They pointed out that, not only were they justified in declining to grant an advance five or six weeks ago, but that trade was now actually worse than it was before the strike began, and that, therefore, they could not entertain the suggestion that they should raise wages. At the same time, they made it quite clear that they were willing, whenever trade improved, to discuss the point with the men. In the present circumstances they regretted exceedingly that they could offer nothing in the way of a compromise. The men's delegates, on their part, stated that an advance of wages was the only way in which the dispute could be compromised. As on this, the crucial point, the parties were absolutely at variance, the conference dissolved, without coming to any understanding which might lead to a termination of the strike. At the close of the conference, the secretary of the Clyde Shipbuilders' Association said, when interviewed, that he could make no report as to the proceedings except that the conference was over, that no agreement had been arrived at, and that there was no arrangement for another conference. Although, he added, the employers, of course, are willing to meet the men in conference at any time. The men's delegates, when asked as to the result of the conference, gave an almost similar reply. The conference, they said, had been a failure, so far as settling the dispute was concerned, and the strike would have to continue.

From several of the Clyde shipyards during the past four or five months, a number of steamers and sailing vessels have been turned out, all to the order of the Navegacion a Vapor Nicolas Mihanovich, of Buenos Ayres, and possessing special features appropriate to the service for which they are intended. The largest and most noteworthy of the steamers is the paddle steamer *Viena*, just completed by Messrs. A. & J. Inglis, of Pointhouse. She is a handsome vessel of 330 ft. length, 72 ft. breadth (extreme) over the sponsons, 31 ft. depth, and having a gross tonnage of 2,700. She has upper and awning decks above the main structure deck, long tiers of deckhouses and remarkably roomy and airy accommodation for 400 first-class passengers, and a large number of second. She attained on her speed trial, on the 18th ult., in blustery weather, and through somewhat rough seas, a speed of 16½ knots—considerably over the speed guaranteed. For the same owners, Messrs. William Denny & Brothers, Dumbarton, have produced, during this period referred to, three sailing vessels, 250 ft. in length, 35 ft. beam, and 11 ft. 6 in. depth. These vessels are square topsail schooners, designed to carry a considerable deadweight on limited draught. A feature somewhat unusual in sailing ships is a navigating bridge, fitted across the roof of one of the deckhouses, from which the vessel is steered and controlled, as steamers are. The arrangement has been found by the owners to be specially suitable for river navigation, such as the vessels are intended to engage in.

Messrs. William Simons & Co., Renfrew, launched from their works, on the 22nd ult., a twin-screw stern-wheel combined bucket and pump reclamation hopper dredger, named the *Karnafuli No. 1*, constructed to the order of the Chittagong Port Trust, for the improvement of the harbour works at that port.

The Ailsa Shipbuilding Company, Ltd., of Troon, since recently adding engineering works to their establishment, have been kept well employed in this department. Not only so, but the prospects of future work are such that the company have applied for, and have been granted, power to make an extension to their engine shop, which will almost double it in extent and more than double it in capacity. The present shop is 150 ft. long, and the authorised extension is for 100 ft. more, at a cost of £1,200. Among the work in hand at present is a quantity of shafting for South America; while the first set of engines constructed by the firm have just been fitted into the steamer *Kelpie* (of 180 ft. length), launched for Belfast owners on the 4th ult. The engines are of the compound direct-acting type, having cylinders 20½ in. and 44 in. diameter, with a stroke of 30 in. The company are also busy in their ship repairing department, for which the two dry docks under their management afford splendid facilities. An important job of this nature just completed is the thorough overhaul of the hull and machinery of the large steamer *Fontabelle*. This vessel, formerly owned by the Quebec Steamship Company, has been purchased for Brazilian owners. She is an iron steamer, now twenty-four years old, having been built in 1882 by the London and Glasgow Shipbuilding and Engineering Company to the order of Messrs. Jenkins, of the "London Line." Her name, until purchased by the Quebec Steamship Company, was the *Pembrokeshire*. She will henceforward be known as the *Canoe*, and registered at Rio de Janeiro. Her boilers have had new combustion chambers fitted, and been completely re-tubed, while her engines have been overhauled. Part of her cargo to South America will be two steel barges, shipped in sections, which have been built by the Ailsa Company.

Since the ceremonial opening of the first section of the new buildings of the Technical College in Glasgow, by the Right Hon. John Sinclair, M.P., on December 21st, 1905, a commencement has been made with the second section of the new building, and the foundation work has been completed, but operations have been suspended for lack of funds, as the Governors do not propose to incur liabilities for further contracts until they have some assurance that what is necessary in that way will be forthcoming. The equipment of the engineering laboratories has received very careful consideration, and the following are among the principal items of new apparatus which have been, or about to be, installed, viz.: Horizontal testing machine, 100 tons; gas engine and suction producer plant, of 10 to 15 B.H.P.; horizontal steam engine; a Diesel engine; an Otto-cycle oil engine; a separately-fired superheater; a compound air compressor; and an ammonia refrigerating plant.

Messrs. Ramage & Ferguson, Leith, have received an order from the Newcastle (N.S.W.) and Humber River Steamship Company for the construction of a mail and passenger steamer of medium dimensions.

The Caledon Shipbuilding and Engineering Company, Ltd., Dundee, launched about mid-month the steamer *Dundee*, which they have constructed to the order of Messrs. Mackay, of Hamilton, Ontario, and specially designed for the grain trade on the Canadian Lakes, as well as, if at any time advisable, for the voyages across the North Atlantic, to and from this side. This special class of vessel the Caledon Company has already shown itself proficient in dealing with, and there is every probability of an increased demand.

The Dundee Shipbuilding Company, Ltd., has launched a powerful steam trawler, the *Mary*, to the order of Messrs. Marr, of Fleetwood. This is the company's first vessel since its re-construction, and the engines have been supplied by the Shields Engineering and Dry Dock Company.

THE TYNE.

(*From our Own Correspondent.*)

Shipbuilding. Up to the present, nothing has arisen to indicate the probability of a lock out of the "black squad" by the shipbuilders of the North-East Coast, as a tactical move in support of the Clyde employers, whose men are now on strike. Should the dispute not be settled very speedily, however, it is quite on the cards that even such a drastic measure may be resorted to. Should such a contingency come about, the power of the Boilermakers' Society in connection with shipbuilding will receive a rude shock, if it is not quite destroyed. For the employers, however silent they may be upon the subject, cannot fail to be aware of the fact that for many years two yards in the district have been carried on successfully without the aid of the society men; and it is patent to everyone that, when that can be done, no very serious difficulty would arise in carrying on the work of all the yards by non-union men, should such be necessary. At this moment, the Boilermakers are on very thin ice indeed, and it will behove them to walk with ex-

ceedingly great care to avoid being submerged. What is bound to happen sooner or later—but which may be postponed awhile if the Boilermakers are reasonable—may come to pass at any moment if they continue recalcitrant—that is, the opening out of the trade to all who are capable of doing the work. The shipbuilding firms of the North-East Coast have put up with much from the Boilermakers' Society, even going so far as to permit the latter to have full control of the yards, so far as regards the "starting" of men, no one being allowed to "start" unless they are "in compliance." To avoid conflict with this body, they have, to a large extent, abrogated their own authority. But they have apparently begun to realise that they who pay the piper are entitled to the privilege of calling the tune; and it will be dangerous for the Boilermakers' Society any longer to maintain the arrogant attitude of the past.

The announcement has appeared that Messrs. Moss & Co. have placed with Messrs. Swan, Hunter & Wigham Richardson, on behalf of a French company, an order for two twin screw steamers of about 10,000 tons capacity each, and designed for a high rate of speed. It is also stated that the Union Steamship Company, of New Zealand, have placed with the same builders an order for two cargo boats of 3,100 tons, and 7,500 tons capacity respectively. This eminent firm have also booked an order for a large pontoon dock, to be located at the port of Trinidad; and, however slack other firms may become in the near future, it is tolerably certain that the famous Wallsend yard will remain busy throughout the winter.

Messrs. Armstrong, Whitworth & Co. have commenced the making of an additional building berth at their Elswick yard, with the view of providing accommodation for the building of even larger war vessels than they have hitherto been called upon to undertake. The new berth will be over 650 ft. in length, and will have a foundation composed of ferro concrete piles, varying from 40 ft. to 50 ft. in length. A new wharf of great extent is also being formed, and other extensions are contemplated. The company are also carrying out further improvements at their Low Walker yard, where at present there is but a limited quantity of work in hand.

Messrs. Hawthorn, Leslie & Co. have contracted with the Admiralty to build two coastal destroyers of a new type, which will be somewhat larger than those now being completed at other yards, and will be adapted for the burning of patent fuel. The locomotive works of the same firm at Forth Banks, Newcastle, are just now very busy, having in hand, in addition to many home contracts of importance, ten tender locomotives for a foreign railway, and two motor coaches for Port Talbot and the Isle of Wight respectively. The Palmers Company have received an order from the Admiralty for one coastal destroyer of the new type, and they have, it is understood, also secured one or two orders for merchant vessels. The fitting out of the battleship *Lord Nelson*, launched early in September, is being pushed on with all possible despatch. The Northumberland Shipbuilding Company's yard is still quite full of work, and the same may be said of Messrs. Readhead's establishment. The smaller yards continue to be well supplied with work, the state of business at the Smiths' Dock Company's works being particularly good.

Engineering. A conference on the wages question has taken place in Newcastle between representatives of the employers and the operatives, with the result that it was made clear to the latter that at the present time all attempts to obtain an advance of wages would be futile. It is understood that meetings are being held by the men this month to decide upon their future action in reference to the claim that was made on their behalf; but, in view of the firm attitude adopted by the employers on this subject, it is unlikely that anything further will be heard of it, during the present year, at all events. It is reported that the Wallsend Slipway and Engineering Company have been commissioned to supply the machinery for the two twin-screw steamers about to be built at the Wallsend yard of Messrs. Swan, Hunter & Wigham Richardson, Ltd. The St. Peter's Engine Works are kept exceedingly busy; but at one or two establishments further down the river, signs of lessening activity are beginning to be seen. Diminished pressure of work is also to be noticed at many of the foundries, and most of the forges are short of work. Messrs. Newton & Nicholson's Corrugated Packing Works, Tyne Dock, continue to be actively employed, and the firm are now developing another line in engineering accessories, in connection with which very satisfactory progress has already been made. The engine-repairing establishments at this centre are, in nearly every instance, kept pretty briskly going. Messrs. Scott & Mountain's electrical engineering works at Gateshead have some good contracts in hand for mine equipment, in pumping machinery and other specialities. The installations already fitted by this firm, have, we understand, in every case, given satisfaction. Messrs. Holzapfel's works at Heworth Shore, which were built a couple of years ago, expressly for the manufacture of the compositions used for ship painting, with which the firm's name is identified, are kept fully going in all departments; and, as the scope of operations shows a steady extension every year, it is quite within the bounds of probability that additions to the works will have to be made ere long.

THE WEAR.

(*From our Own Correspondent.*)

Shipbuilding.—Among the more enterprising firms engaged in shipbuilding, there appears to be a disposition to favour the adoption of pneumatic tools for riveting, caulking, &c., in a wider sense than has been hitherto done; and in this connection we learn that Messrs. J. L. Thompson & Sons, of the North Sands Yard, have decided to equip their yard with a full pneumatic installation. We understand that installations of this kind have not invariably given satisfaction; but where failure or partial failure has resulted, it is probable that the cause lay, not in the system, but in external influences brought to bear unfairly against it. In the case of the North Sands firm, we opine that when the system is in proper working order, satisfactory results will, without doubt, be obtained. The firm continue to have all their berths occupied, and the yard is likely to be kept busy over the winter.

We are pleased to be able to state that the oldest firm in the Southwick district (Messrs. Robert Thompson & Sons) have recently acquired a piece of ground adjoining their yard, which they intend to incorporate with their existing shipbuilding premises. It is expected that through this addition a very important development of the firm's resources will be effected in the near future. The firm have not at present much work in hand; but at the Bridge Dock business is pretty active.

Messrs. Doxford have received an order from a Gothenburg firm for a large turret steamer, to be ready for delivery early next year. During the nine months ending September 30th the firm have launched eighteen vessels, having an aggregate capacity of close on 71,000 tons; and it is expected that the total output for the year will not be far short of 100,000 tons. Even if that high figure is not reached, it is safe to assert that the firm will have an output this year that will easily outdistance all previous records. At the yard of Sir James Laing & Sons there is undoubtedly a pressure of work, both in the new and in the repair departments; and we think it may be said that, on the whole, the yards of the Wear are more uniformly busy than those of the Tyne, or that other North-East Coast district comprising Middlesbrough, Stockton, and the Hartlepools. It may be added that unemployed riveters, &c., from the latter towns are arriving in Sunderland daily, and readily obtaining work.

Engineering.—In the Wearside engineering works, there does not appear to be any falling off of activity, though it is a matter of common knowledge that new orders are now very difficult to negotiate. In the smaller, as well as in the larger works, business remains good; but one or two of the local foundries are beginning to run short of work, which circumstance must be regarded as unfavourable to the prospects of the engineering trade. In the forges, little change is to be noted; but the local ironworks seem to be less busy.

United States Metallic Packing Company.—In our last issue, by an unfortunate oversight of the printer, an error was made with regard to the number of metallic packings supplied by the United States Metallic Packing Company, Ltd. The number was given as 65,000, and should have been 165,000. We regret this error, and are pleased to take the earliest opportunity of correcting it. We should like to add that these packings are being more extensively used than ever, and we understand they have now reached the substantial total of 180,000.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

MANY people will be surprised to hear that the Manchester Liners, Ltd., made a profit, during the year just ended, of over £26,000. The company were able to carry to the credit of profit and loss account £39,472, after providing for the upkeep of all their steamers and other expenses, as compared with the previous year, when the profit was £15,514. The year before that there was a loss of £13,040. Last year was the best the company have experienced since 1902. Wisely, the directors have carried £25,000 to depreciation account, leaving £1,430 7s. 5d. to go forward to the next account; £124,917 has been written off for depreciation since the company started.

Sir Christopher Furness, M.P., the Chairman of the company, told the shareholders that the directors encountered strong opposition to their River Plate service, by the shipping ring, but the service was started in response to the invitation of shippers, and was making progress. They had associated themselves with Messrs. Leyland & Co., and the service was run jointly. He hoped to be able to announce ere long a weekly service.

The importations of timber at Mersey ports during the past month have been liberal, and the stuff has met with a good demand. Values have been well maintained. Wavy pine has been imported on a large scale, chiefly on contract, to Manchester. Up to September 30th, from January 1st, sawn pitchpine figured at more than 1,135,000 cubic feet.

The development of the trade by the Canal at Partington coal basins has been considerable. Coal is exported almost daily.

The new cotton season, so far, shows a decided improvement. Engagements made up to the close of the year are on a satisfactory scale, especially from American ports. The cotton grown in the States is likely to prove exceptional. The New Orleans season is opening out much later than Galveston. The first vessel was the *Manchester Mariner*. The Manchester berth at Savannah and Brunswick is again in charge of Messrs. Sivewright, Bacon & Co. Several cotton-laden vessels have already arrived. Steamers from the Gulf ports, in addition to cotton, are bringing large quantities of grain. Considerable quantities of phosphate rock, which is used largely by works situated on the banks of the Canal, are being landed at intervals.

The Alexandra service, which was so well maintained by the Prince Line last season, is being resumed. Several cargoes of Egyptian cotton have already been landed.

Three sailings per week by the Manchester-Glasgow Line from each port are being inaugurated this month.

The difficulty of cleansing the Ship Canal of the filth that is continually running into it is as great as the cleansing of the Augean stable by Hercules. It is no wonder that jokes are made about it. The best I have yet heard was contained on a postcard from Wales, addressed to "*Pneumonia* Docks, Manchester," and was duly delivered at Pomona Docks.

It has been decided to run a new line of steamers between the Mersey, Manchester, Preston, and the East Norwegian seaboard towns. The sailings are to be fortnightly, and oftener, if required. Ten Norwegian steamers are to be employed in the service, ranging from 900 to 2,000 tons. It will be called the Biornstad Line. Cargo will be carried at through rates to all Lancashire and Irish ports. The English agents and representatives of the line are Messrs. H. Tyrer & Co., of Manchester, Preston, and Liverpool.

Our exports of textile machinery continue to increase. The returns for September exceeded those of September, 1905, by nearly a million sterling, and considerably over a million, compared with September, 1904. Despite the Russian troubles, her imports have increased during the last two or three months. France shows a revival, and minor European countries are increasing their textile machinery imports, and more machinery is going out to China, Japan, India, and South America.

The steamer *Maningtry*, owned by Messrs. Sivewright & Bacon, Manchester, has been lost at sea while on a voyage from Huelva to Philadelphia. The vessel was abandoned, but the crew were saved and landed at Fayal. The *Maningtry* was built in 1894 at West Hartlepool, gross register 2,845 tons.

The revenue of the Ship Canal for the first nine months of the present year shows an advance on the nine months of last year by £37,983. The September increase was about £4,000.

The Watson Steamship Company have purchased a new steamer, the *Ellesmere*, for the fruit trade between Manchester and Mediterranean ports. The vessel was launched about a fortnight ago. She is 2,040 tons deadweight, and is specially equipped with all modern appliances for the transport of fruit. The growth of the fruit transit trade has been very steady and progressive at the Manchester docks. The seasons ending June 30th, 1903, 1904, 1905, and 1906, showed the following results: Green fruit (cases), 200,000, 250,000, 300,000 and 450,000 consecutively. Other cargo increases during the same periods were: 4,000 tons, 10,000, 13,000, and 19,000 respectively.

The Manchester iron market has been gradually increasing in tone and strength during the month of October, until prices are abnormally high. The real cause of this is the greatly increased demand for raw material on the Continent of Europe and in the United States, coupled with our own strong home and foreign trade in engines, railway metal, and textile and general machine industries. Local buyers take just as much iron as will meet current requirements. There is little forward buying, although, in some instances, contracts have been concluded for deliveries up to the spring, and even later, of 1907. Copper and tin are at fancy prices, which vary almost daily, but the general tendency has been upwards. Average quotations of raw and manufactured iron are as follow: Scotch pig: Eglinton, 66s. 3d.; Dalmellington, 66s. 3d.; Glengarnock, 66s. 9d.; Gartsherrie, 69s.; landed at Manchester Docks; 2s. 3d. less, if delivered at Fleetwood or Heysham; and 1s. less, if landed at Preston; Middlesbrough, 64s. 9d. to 65s. 3d.; Derbyshire, 61s.; Staffordshire, 60s.; Lancashire, 61s. 6d. to 62s. 6d.; Lincolnshire, No. 3, 59s. 6d.; ditto, No. 4, foundry, 57s. 6d.; ditto, No. 4, forge, 56s. 6d., delivered Manchester; Hematites (West Coast), 69s. 3d., at makers' works; ditto (East Coast), 69s. 9d., f.o.b. (Tees). Manufactured iron: Steel bars, £7 5s. to £7 10s.; angles, £6 15s.; tees, £7 2s. 6d.; flats, channels, and joists, £7; iron bars, £7 5s. to £7 10s.; steel boiler plates, £8 12s. 6d.; steel sheets, £8 10s.; steel hoops, £7 17s. 6d.; billets, £5 12s. 6d. to £5 15s. 6d.; steel ship plates, £7 to £7 5s. Seamless copper tubes, 1s. 1¼d. per lb.; brazed, ditto, 1s. 1d.; seamless brass, ditto, 10½d.

During the month all classes of house coal have been raised 10d. per ton. This agreement on the part of colliery owners in the Manchester district has been, so far, loyally carried out; a week ago the Wigan and Staffordshire coal owners agreed to raise the price of house coal 1s. per ton from to-day (November 1st). There has been no grumbling on the part of the public. It is not unusual for house coal to be raised in price at the beginning of winter. The trade up to now has not been very buoyant, but shows some increase. In all kinds of steam coal, and in coal for shipping, the demand has been very good. Coal for shipping and for export continues satisfactory. We have even sent a cargo to Constantinople. Average quotations: Best house coal, 13s. 6d. to 14s. 6d.; secondary, 12s. to 13s.; common, 9s. 6d. to 10s. 6d.; steam and forge, 8s. to 9s.; best engine fuel, 7s. 6d. to 8s. 6d.; best slack, 6s. 9d. to 7s. 6d.; medium, 6s. 6d. to 7s. 6d.; common, 5s. 6d. to 6s. 6d.; coal for shipping on the Ship Canal, 9s. 6d. to 10s. 6d. Some qualities are even higher.

THE THAMES.

(*From our Own Correspondent.*)

WITH the holiday season duly past, the activity of public bodies recommences, and the large question of the Port of London looms up prominently once again. At a meeting of the Thames Conservancy, it is proposed that only the entrances to the docks and water areas be acquired by the new authority. The effect of this would be that the dock companies would be left in possession of their warehouses and quays. Another point put forward by those in charge of the river is that the upper and lower reaches shall not be divided for the purposes of future administration. There is thus divergence between the views of the Conservancy and those of the representative committee, that lately met under the control of its chairman, Lord Desborough. A prominent member of the deputation lately

visiting Continental ports gives it as his opinion that what London requires is more wharves and jetties, and not enclosed docks. Whatever increases can be shown for foreign ports, the report of the Conservancy shows a gain in nine months of this year, over the same period last year, of 807,915 in tonnage entering the port. The President of the Board of Trade has called on the Conservancy and the Chamber of Commerce to formulate their views on the question, for his guidance. Meanwhile, Liverpool is bestirring itself in the matter, and is against any Government guarantee in connection with the issue of port stock, which would buy up the docks on the river. The argument is that if this is done, it would be unfair to all the other ports of the kingdom.

The much-discussed river steamboat question has come to another stage by the cessation of the service for the winter and the discharge of over 200 boatmen. The watchmen will take charge of the boats laid up, as well as the piers. There is considerable discontent among the discharged men as to the conditions of their employment, and the matter is being arbitrated upon.

The General Shipowners' Society, which represents the London shipowners, has given its support to the action of the London Local Marine Board in its opposition to the Board of Trade, and has formally recorded its opinion in a letter which has been forwarded to Mr. Lloyd-George, as the President. Meantime, the circular issued by the Government has produced a deadlock, shipowners and masters apparently being unanimous in brooking no interference with their authority, as given the latter by the Merchant Shipping Acts.

The Union-Castle Steamship Company has declared an interim dividend of 4s. per share on the Ordinary shares for the half-year ending June 30th last. The "Shell" Transport and Trading Company carry forward a sum of over £85,000 to the 1906 account; and the directors state that the war in prices in the East last year adversely affected their earnings, but conditions have since improved.

A curious accident befell a steamer, the *Idalia*, of the Ellerman Line, recently. The vessel collided with a barge laden with tea and coffee, and cut her in two. A man was killed and the cargo practically all lost. The barge was in the dock mouth when the accident happened.

A notable figure in the shipping world has passed away in the person of Mr. John Fenwick, one of the Elder Brethren of the Trinity House, with which he had had connection for practically half a century—a remarkable circumstance. Some of Mr. Fenwick's ships were engaged in transport work in the Crimean War.

Woolwich seems, for the moment, to take a first place as regards the unemployed on the river. The Government, as regards the Arsenal, is face to face with shortness of work and a surplus of labour. It has now been decided to remove the torpedo factory elsewhere to a naval port, not yet decided upon, so this is likely to put a further strain upon the present situation.

The Government has refused a request of the City authorities to appropriate Custom House Quay, below London Bridge, for an extension of the fish market, on the ground that the public have a right to the position as an open space. In view of the congestion existing, authorities are probably in something of a dilemma over the matter.

The London County Council, in its activities, in a measure controls the Thames by the authority it has over some of its bridges, and, again, by tunnel. The latest addition in this latter direction is the Rotherhithe Tunnel, which is likely to be opened in 1909. The work comprises a carriage and two footways, the former 16 ft. wide, and each of the latter 4 ft. 8 in., the tunnel length being 1,200 yards. The position of this new subway is from the Lower-road, Rotherhithe, to Commercial-road, Stepney, so it will be seen to be in busy districts, and practically linking up the Surrey, Commercial, and London and India Docks. Such an important piece of engineering work does not present the difficulties it used to do, with the shield system of tunnel construction now in vogue; and driving goes on at the rate of about 55 ft. per week. The six air compressors employed are capable of delivering 1,000,000 cubic feet of air per hour. In the excavating a small pilot tunnel of 11 ft. diameter is first driven, and this is practically across the river already, it is understood. The Society of Engineers recently paid a visit to this important piece of work.

Quite a variety of celebrations connected with sailors have occurred recently, and it will not be for lack of public support if our seafaring interests in any way die. There has been the annual national service for seamen at St. Paul's, where, it is computed, 3,000 men at least were present, and representatives of different institutions that have to do with the Royal Navy and mercantile marine. Nelson's Day has been another occasion of the kind, and crowds were drawn to see the decorations of the column in Trafalgar-square devoted to the memory of the departed hero. A service was also held in St. Martin's Church, close by, with the same object in view.

As we have remarked in this column before, London's near ports are bestirring themselves; and now it is the turn of Lowestoft and Yarmouth to make a move. A new dock has been opened at the former place, and this affords nine acres of additional water area and 1,600 ft. of landing space. At Yarmouth, powers are to be sought for a new dock on the South Denes, to provide additional accommodation for the fishing industry, the cost of which is estimated at £75,000, to accommodate 250 more vessels.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—There is not much that is new to note in the condition of the shipbuilding trade of this district. The demand for ordinary shipbuilding tonnage is quiet, and there is not much to record about warship orders except the fact that Vickers, Sons & Maxim have commenced work on one of the three Brazilian battleships ordered in this country, and also on the three sets of engines for these ships, all of which engines will be built at the Barrow yard. Further than this, Vickers, Sons & Maxim have secured the order for six submarines, required by the Admiralty. These vessels represent a new type, which has been evolved from the experience of the "A," "B.," and "C." types of submarines built at Barrow. They are much larger than any previously built, and are designed for a much larger radius of action. They will be fitted with two sets of propellers, and will, therefore, be driven with two separate sets of engines. It is noteworthy that these vessels will contain much more accommodation for officers and crews; and it is evidently intended that they shall be away from their base for some length of time, as accommodation is provided for a long stay on board. The Admiralty are building some of the same type of submarines at Portsmouth. There is plenty of room for new ships to go down on the slipways at Barrow; but the firm, having equipped itself mainly, and almost exclusively, for the building of ships of war, are not disposed to take orders for the ordinary mercantile marine if they can avoid it. They have consequently passed much business which would otherwise have come to Barrow. This policy may be a wise one, looking at the *tout ensemble* of this great firm, but it is not a satisfactory one for workmen or for the town of Barrow, because it leads to great irregularities of work, as it is impossible to get a regular run of warship orders. The demand for warships goes in fits and starts. It may be that shortly Vickers, Sons & Maxim will be very busy in this department, because it is known they have been angling for important orders from Russia and other great Powers, and have, as a fact, been expecting new work for some time past. This is the reason why the yard has been so bare of orders of late. It is anticipated that ere long some of the largest ships ever built will be put down at Barrow, where there are slipways capable of building vessels 1,000 ft. in length, and of any width and weight, and where, also, dock improvements are being made and entrances widened, so as to admit of vessels up to 100 ft. in width.

The launch of the Russian cruiser *Rurik* has been deferred until July 17th, in consequence of the time required to repair the damage caused by the recent explosion. Several Russian naval officers have arrived at Barrow to take charge of the vessel, and three vessels of the Russian Fleet recently in Belgian waters have come to Barrow, with a view to enabling her officers and crews to see the fine new cruiser *Rurik* launched. She is admittedly a powerful vessel, and the Russian Admiralty have had the advantage of the experience of Vickers, Sons & Maxim in the designing of the vessel, which probably will be a type on the lines of which other Russian cruisers will be built. The chances are, however, that Russia before long will put down some "Dreadnoughts," especially now that this new departure in naval construction has proved such a success, not only in speed and seagoing qualities, but in real fighting power.

Vickers, Sons & Maxim are naturally proud of the success of the *Dreadnought*, as they built her turbine engines and auxiliary machinery, and supplied half her guns.

The second of the Peruvian cruisers or scouts, *Coronel Bolognesi*, is being rapidly completed for her trials, and the *Almirante Grau* is being fitted out for her voyage to South America. The Canadian ice-breaker, built at Barrow, has been delivered, and is to be employed forthwith in her mission in breaking up the ice of the River St. Lawrence.

West Cumberland.—Considerable activity is to be seen at the shipbuilding yards at Workington and Maryport, and a continued run of orders is being arranged for, although the demand for small craft has somewhat fallen off of late.

Shipbuilding Material.—The demand for shipbuilding material is not so brisk as of late, although the plate mills are running full time. Makers, however, have not many orders on hand, and they do not expect many from outside sources. They are, however, looking forward to new orders on local account. Heavy ship plates have been reduced in price, and £7 is now the net cash quotation. Steel foundries are quiet, but expect to be busier.

Hematites.—The hematite trade is very firm, and makers are heavily sold forward. Mixed Bessemer Nos. are quoted at 71s. net f.o.b.; and warrant iron is at 69s. 11d. net cash sellers. Warrant stocks stand at 73,201 tons.

Shipping.—The shipping trade is steadily employed. The exports of iron and steel this year have reached 665,736 tons, being 2,466 tons decrease on the corresponding period of last year. Freights are steady.

BELFAST.

(*From our Own Correspondent.*)

LLOYD'S RETURNS show, unfortunately, a decrease in work in progress in the Belfast yards since the quarter ending September 30th, 1905. For the three months ending on that date, the amount was 213,530 tons, whilst for the corresponding quarter of the present year there was a drop to 132,540 tons. Notwithstanding the falling off, trade has not been what could really be termed bad.

On October 18th, Messrs. Harland & Wolff launched from the south end of their yard a steel screw steamer, named *Aburi*, for the African Steamship Company. The vessel is 370 ft. long, by 49 ft. broad, and has a gross tonnage of about 4,000. The *Sierra Leone*, sister ship of the *Aburi*, will be launched from an adjoining slip a few weeks hence. According to present arrangements, this vessel will complete the Queen's Island output for 1906. The big vessel which this firm has in hand for the Hamburg-American Company will have a length of about 738 ft., and a gross tonnage of over 30,000. The keel of this leviathan has been laid down on the slip vacated by the White Star liner *Adriatic*, the vessel's yard number being nailed up at the head of the stocks ere the British rival was fairly waterborne. The White Star liner *Gothic*, which was overhauled at the Queen's Island, left on the 10th of the month for Cardiff, where she was dry-docked, owing to the want of graving-dock accommodation in Belfast. Messrs. Harland & Wolff have at present the old Pacific liner *Orotava* in hand for repairs and overhaul. Amongst other repair work carried out recently by them may be mentioned the damage repairs to Messrs. Burns's new steamer *Partridge*, which touched the Gobbins during a dense fog on September 29th. The stem, a length of keel, and several shell plates under and aft of the forefoot had to be renewed, and, in consequence, the vessel was laid off service for a couple of weeks. At the fitting-out berths, Messrs. Harland & Wolff have the White Star liner *Adriatic*, the British India Company's *Rohilla*, the Leyland liner *Servian*, and the African Steamship Company's *Aburi*. H.M.S. *Hibernia*, engined by the Queen's Island firm, has completed most of her trials; the tests so far carried out have proved entirely successful.

Messrs. Workman, Clark & Co. have one or two new steamers to put in the water before their output for 1906 is complete. On October 4th they launched from their South Yard a fine new steel screw steamer for the Ulster Steamship Company, Belfast. The new vessel, which is named *Howth Head*, is 394 ft. 6 in. long, by 48 ft. 2 in. broad, by 31 ft. 6 in. deep, with about 5,000 tons gross register. She is the seventh vessel built by this firm for the Head Line. On October 2nd the *Star of Japan*, constructed by Messrs. Workman, Clark & Co. to the order of Messrs. J. P. Corry & Co., London, had a successful trial in the Lough. The latest addition to the Star Line fleet is a vessel 456 ft. long, having a gross tonnage of 6,300. She has been specially designed for the company's trade between Australia and New Zealand and the Mother Country.

The Belfast Harbour Commissioners' No. 3 dredger is at present in the Hamilton Graving Dock undergoing repairs to the damage caused by her being run into by Messrs. Sloane & Co.'s steamer *Tweed*.

The shipping of coal from English and Scotch ports to Belfast is a trade of considerable importance, Ireland being dependent upon the predominant partner for both house and steam coal. This keeps in constant employment a fleet of steam colliers, which is being continually added to, the latest additions being the steamers *Ailsa Craig* and *Kelpie*. Both these vessels have been constructed by the Ailsa Shipbuilding Company at their Troon yard, the former for Messrs. Hugh Craig & Co., and the latter for Mr. John Kelly.

At a recent meeting of the Londonderry Harbour Commissioners, the graving dock question was once again brought up, two hours being occupied in debating the question of proceeding with the construction of a graving dock, involving an outlay of £70,000. A motion "That, as recommended by the committee, the engineer be instructed to procure the necessary boring tools, and proceed with the work of making borings at the site suggested for a new graving dock," was proposed, and seconded by Mr. William Donnell, J.P., and Mr. P. Breslin, J.P., respectively. In an amendment, Mr. John Cooke, D.L., went fully into the financial position of the Board, and declared that the dock scheme would land it in bankruptcy. Mr. Donnell argued that, by its docks, Belfast secured shipbuilding; but Mr. Cooke rightly contended that the contrary was the fact—that the shipbuilding went to Belfast before the docks, and that it was only when the shipbuilding had developed that the dock construction began. Finally, the motion to proceed with borings was lost, only three members supporting it.

Art and Science of Sail Making. By S. B. Sadler. London: Crosby, Lockwood & Co. 1906.

THE author considers no book has hitherto been written on this subject which deals with it in a proper scientific manner. He considers the principles that underlie the question are too often neglected, and with the result that improperly made sails cause the loss of vessels in some cases. Baggy sails, he says, press the vessel down and there is no freedom for the wind's exit out of the after leech. The author shows the necessity of the sailcloth being of the best make, and that it will stretch to the necessary extent to prevent an uneven and pressing sail. Tables are given showing the numbers of the canvas for different kinds of sails, also sizes for bolt ropes. The question of the centre of effort of a sail is closely gone into and shown for two forms; first, a jib-headed topsail and a fore and aft mainsail. It is seen how to measure a vessel for her sails also, and practically every form of sail is shown with dimensions. We have also the number of cloths required in a sail. The importance of this subject is shown by the allowances that are made for the stretching tendency of the canvas, as, if these allowances are not made, baggy sails will follow, and this is against efficiency. Gores in sails are also of importance in the cutting out, and need careful attention; and, even when the sail is shaped correctly, it needs roping. The rope has to be put on so as to be fair when the canvas is stretched. The matter is therefore not a simple one. The mysteries of the art are still further complicated by such variations as diagonal and horizontal cut sails. The former appears to be the more important, judging by the space allotted to it. This naturally has to do with the seam of the canvas and the effect produced on the stretching of the same if it is cut one way or the other. It will be evident therefore, judging by this book, that if we are to obtain good results from the wind on our sails we must make them with the greatest care, of the best material and fashion, and no detail is too trifling to be attended to, apparently. There is a great deal more in the matter than appears at first sight. We can only thoroughly commend this book to all those interested, and, from a racing point of view, the subject is very important, and will be readily understood.

JUNIOR ENGINEERS.

II.*

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any Queries or explain any points that are not perfectly clear, and to recommend Books on the various subjects under discussion.

PATTERN MAKING (*continued*).

IN making a pattern from a detailed drawing, there is little scope for originality of design, but individuality will show itself in the workmanship and the method of piecing the patterns together for ease and celerity of removal from the mould, in divining the line of parting and the upper side for casting. This knowledge is the outcome of long experience, and is the birthright of the specialist.

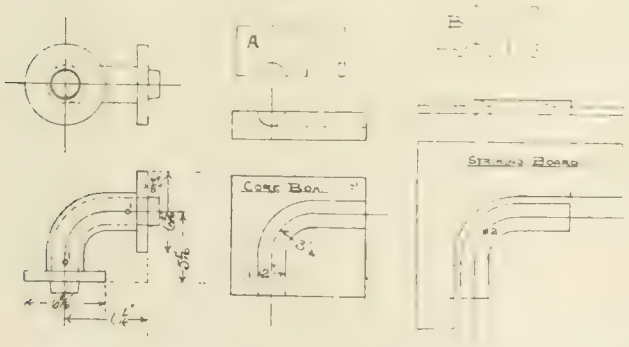
Whatever of unstable impurities the metal may contain will go to the top of the casting, hence the least liable to be affected should be made the upper side of the mould.

The line of parting will usually be through the centre of gravity of the main core, in a plane horizontal or vertical to the major axis, or along the top face of a pattern which can be entirely removed from above.

The main pattern being provided for, the fixing of the remaining portions upon it will be decided by the possibility of drawing them into the cavity formed by the removal of this main body; these pieces are unscrewed as the sand is built round them, so that, when the moulding is complete, all the parts are detached and ready for removal.

With the simpler patterns, neck bushes, plain brackets, pipes, and cast patterns, unscrewing is not required, the two moulding boxes each taking half of the pattern.

The most widely-used wood is yellow pine—a moderately close-grained wood, free from knots, easy to work, and not liable to split. For small standard patterns, mahogany is



employed—a harder and close-grained wood—which is not so readily damaged as pine. Beech and fir are also used, oak and sycamore not so largely; dowel-pins, for holding two parts of a pattern or core-box together, are frequently made of oak, beech, or sycamore.

Where a large number of castings are required off the same pattern, a wooden pattern is made in the first instance, double contraction being allowed for; from this a casting is made, which is then used in forming the mould, the wear and tear on a pattern of this type being practically nothing.

The usual contraction allowances for general marine work are: For brass or steel, $\frac{1}{4}$ in; iron, $\frac{1}{8}$ in.; copper, 5-16ths in.; and zinc, $\frac{3}{8}$ in. per 18 in.

The machining allowances are $\frac{1}{8}$ in. for brass, and for iron or steel from 3-16ths in to 5-16ths in., to suit all the requirements of the work.

For ease in drawing from the mould, the pattern is made with a slight taper; this may vary according to the nature of the work, for an air-pump or cylinder, which are moulded vertically, the taper will be 1-16th in. to $\frac{1}{8}$ in. on the diameter.

* First article appeared in our last issue.

The various methods of forming moulds may be classed under solid, skeleton, and loam patterns.

The first is the usual type for general and standard work, the core being made separate from the pattern, and placed in the mould. The pattern is made of the same outer form as the required casting, but having the necessary contraction and machining allowances. Cast patterns, already referred to, are cleaned with hydrochloric acid for iron, ammonium chloride for brass, well-brushed and black-leaded; white metal for small flat patterns is seldom used in marine work.

Of solid wooden patterns, those of large dimensions will be built up in box form, smaller pieces being cut out solid, and screwed on. To support the cores in the mould, "prints" are attached where the cores are stopped, on flange faces, or wherever possible; these prints will vary in thickness from $\frac{3}{4}$ in. up to 2 in., according to the dimensions and weight of the cores.

The bend pattern is in this case made in halves, dowelled together, as shown at 1, 1; the flanges and prints, also in halves, are then screwed on, fillets being formed by the moulder. The thickness of metal is scribed on to dotted lines on one half, that one having the holes for dowel pins, this forming the outline of the core to the face of the prints.

The core will be formed by means of a core-box, in this case one half only being required; the other part of the core will be made by working the scraper, A, round the lower half of the core in the box. Where a complete box is necessary, the two parts will be dowelled together in the same manner as the pattern.

A more usual and cheaper method of core-making for this class of work is by means of the striking-board and scraper, B. These may be from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. thick, and cut to the shape shown. The scraper is worked round the board, using the projecting lip as a guide. The path thus traced out forms one half of the core. The board is then reversed, and the process repeated for the other half, the board being notched to indicate where the core is stopped. The breadth of the guiding lip may be from $\frac{1}{2}$ in. to $\frac{3}{4}$ in, the radius of the board being greater than the extreme radius of the core by this amount.

Further support in the mould is given to cores by means of wire "chaplets"; these are strung through the core, as at 2, by the moulder, and terminate in the mould sand; the molten metal forms round the wire, and, on cooling, the projecting ends are removed. These chaplets are a source of weakness in the casting, as there is a tendency for a film of vapour to form round them at the instant of casting, thus preventing the molten metal making them an integral part of the casting; hence, where at all possible, it is better not to make use of such.

This is one of the most simple cases of pattern. Further reference to skeleton and loam work will be considered next month, with their applications to propeller and turbine work.

A contract has been signed by the London representatives of the Spanish Royal Naval Commission in London and the "Long Arm" System Company, for the installation of nineteen electrically operated bulkhead doors for the Spanish cruiser *Reina Regente*, now building at the Port of Ferrol.

Institute of Marine Engineers.—The "Denny" gold medal, which is awarded annually for the best paper read before the Institute of Marine Engineers, will this year be bestowed upon Mr. Robert Mackenzie for his paper on the commercial preparation of CO_2 and experiences with gas cylinders.

Association of Engineers-in-Charge.—On the invitation of the Chairman of the City Lands Committee of the Corporation of London, the members of this Association visited, on October 6th, the new Central Criminal Court, just built on the site of Old Newgate Prison. Mr. William Key gave a most lucid and interesting half-hour's lecture on the building, with special reference to the ventilating and warming installations carried out under his supervision; and the members were then taken down to the basement, where they saw the complete installations working, and afterwards the rest of this really splendid building was inspected. The magnificence of the grand staircase, and the central corridor, under the dome, from which the four courts open, evoked universal admiration.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Marlwood.—On September 19th Messrs. Osbourne, Graham & Co. launched from their yard at Hylton, Sunderland, the steel screw steamer *Marlwood*, which they have specially constructed for the well-known trade of William France, Fenwick & Co., Ltd., of Sunderland and London, and which is the fourth vessel of this type built for this firm. She is built on the self-trimming principle, and carries 3,100 tons on a shallow draught, and has been constructed to take Lloyd's highest class. The accommodation for the officers has been fitted up in the poop, the cabins, saloon, and mess-room being tastefully fitted out in hardwood. The engineers' accommodation is fitted around the engine and boiler casing, under the after end of the bridge. The vessel is equipped with the most modern appliances for economical working of cargo, the winches, steam windlass, and donkey boiler all being supplied by Messrs. Clarke, Chapman & Co., Ltd., of Gateshead, and steering-gear by Messrs. Lynn & Co., of Sunderland. During construction, the hull has been under the superintendence of Messrs. Squance & Ingram, of Sunderland, and the machinery has been inspected by Messrs. Thompson & Eyres, of Sunderland. After the launch, the vessel was taken to the North Eastern Marine Engine Works, Sunderland, to receive her engines, which have cylinders 20½ in., 33 in., 54 in., by 39-in. stroke, and two large boilers, working at a pressure of 180 lb.

Toftwood.—On September 21st, Messrs. R. Craggs & Sons, Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer, 340 ft. 3 in. long, 47 ft. beam, 24 ft. 4 in. depth (moulded). This vessel is being built to special survey to take the highest class under Lloyd's three-deck rule, with one deck laid, having poop, the bridge being extended through to forecastle. Accommodation is provided for captain, officers, apprentices, and engineers, in spacious deckhouses on bridge, the crew being berthed in the forecastle. Cellular double bottom is fitted throughout for water ballast, which is also carried in extra large after-peak tank. Six powerful steam winches are provided of the most approved type, driven from a specially large marine type donkey boiler. Steam-steering gear is supplied, and improved quick-warping steam windlass is fitted forward. The arrangements for handling ship and cargo are most complete in every respect. The machinery will be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, and will have cylinders 23½ in., 39 in., 64 in., by 42-in. stroke, steam being supplied by two large single-ended boilers, working at a pressure of 160 lb. to the square inch. The vessel has been built to the order of the Constantine & Pickering Steamship Company, of Middlesbrough, and, on leaving the ways, she was named *Toftwood* by Miss Florence Cooper, of Erdley, Middlesbrough. The specifications have been supervised, and the construction of both hull and machinery has been superintended by Mr. William Constantine.

Argonaut.—On September 22nd there was launched, from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being: 117 ft. by 22 ft. by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Messrs. The Consolidated Steam Fishing & Ice Company (Grimsby), Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines, by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened, by Mrs. Davies, of Grimsby, the *Argonaut*, after which the company adjourned to the builders' offices, where cake and wine were served, and the customary toasts given and responded to.

Ryall.—On September 22nd, Messrs. William Doxford & Sons, Ltd., launched, from their yard at Pallion, the ss. *Ryall* for Messrs. Stephens, Sutton & Stephens, Newcastle, who are already owners and managers of the turret type of vessel. The dimensions are: Length, 365 ft.; breadth, 51 ft.; moulded depth, 27½ ft.; the deadweight of cargo and bunkers carried is 7,000 tons. The vessel has received the highest classification of the Bureau Veritas Society. Engines and boilers are also being supplied by Messrs. Doxford. The christening ceremony was excellently performed by Mrs. Wilkinson, of Newcastle.

Faithful.—On October 2nd Messrs. W. Harkess & Son, Ltd., launched, from their yard at Middlesbrough, a finely modelled steel screw passenger and cargo steamer of special design, which they have built to the order of Messrs. F. H. Powell & Co., of Liverpool. The principal dimensions are: Length, 220 ft.; breadth, 33 ft. 3 in.; and depth (moulded), 15 ft. 10 in. She is fitted with exceptionally heavy deck machinery and cargo gear, and her engines, by Messrs. Richardson, Westgarth & Co., Ltd., of Middlesbrough, are intended to drive her at a speed of 11 knots loaded. On leaving the ways, she was christened *Faithful* by Mrs Law, of Liverpool, wife of the company's superintending engineer. This is the fourth vessel the builders have launched for these owners.

Elloe.—On October 3rd the large steamer *Elloe* was launched by Messrs. Furness, Withy & Co., Ltd., Hartlepool, the owners being Messrs. Bennetts, of Grimsby. The length of the vessel exceeds 350 ft., and takes Lloyd's 100 A1 Class, and she will be fitted out as a first-class cargo boat, having large hatches and clear holds, allowing of bulky stowage. Six powerful steam winches, extra large donkey boiler, steam-heating accommodation, iron grain-divisions, and shifting-boards will be fitted, special attention being paid to all derricks and lifting gear. The engines and boilers are supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, and the sizes of the cylinders are: 24 in., 39 in., 66 in. by 45-in. stroke, steam being supplied by two single-ended boilers, 16 ft. by 10 ft. 9 in. long, and 180 lb. working pressure per square inch.

Hampshire.—On October 3rd there was launched, from the shipbuilding and repairing establishment of Messrs. S. P. Austin & Son, Ltd., Sunderland, the steel screw steamer *Hampshire*, which has been built to the order of Messrs. Thompson, Elliot & Co., of Newcastle. Her dimensions are: Length (between perpendiculars), 314 ft.; breadth (extreme), 44 ft. 6 in.; depth (moulded), 23 ft.; single-deck type, with large hatchways, and fitted with every appliance for quick loading and discharging; the deadweight capacity will be about 4,700 tons, on a light draught of water. She will be classed 100 A1 in Lloyd's Register, under special survey, and will have ample water ballast capacity, so that the vessel may be able to make good passages in all kinds of weather. Accommodation for captain and officers and engineers is fitted in the bridge, and for the crew in forecastle. The machinery is of large power, and supplied by Messrs. George Clark, Ltd., Southwick Engine Works, Sunderland, and the auxiliary machinery is by other first-class makers. The construction has been superintended by Mr. James Stewart, on behalf of the owners, and the launch was successfully carried out in the presence of a number of friends, the naming ceremony being gracefully done by Mrs. J. Thompson, wife of one of the owners.

Royal Sceptre.—On October 3rd Messrs. W. Doxford & Sons, Ltd., Sunderland, successfully launched the turret steamer *Royal Sceptre*, built to the order of James L. Knott, Esq., Newcastle. The vessel is of their new clear-hold type, one of the latest developments in turret construction; and in general proportions resembles a large number of turrets that the firm has recently constructed. The principal dimensions are: Length, 366 ft.; breadth, 50 ft.; moulded depth, 26¾ ft. A deadweight of 6,600 tons will be carried, on a draught of 21 ft. 9 in. The Bureau Veritas Registry has assigned its highest classification to the vessel. The christening ceremony was performed by Miss M. Hedley, The Nook, Sunderland.

Blackfriargate.—On October 4th Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions: Length, 342 ft.; breadth, 47 ft. 6 in.; depth, 20 ft. The vessel will be classed 100 A1 at Lloyd's, and is built on the two-deck rule, having one deck laid, with break poop, bridge, and topgallant forecastle. Accommodation for captain and officers will be fitted up in the poop, and accommodation for the engineers will be in iron houses on the bridge deck, the crew being berthed in the forecastle, as usual. The vessel has double bottom for water ballast on the cellular principle, also water ballast in the after peak. She will be fully equipped with an up-to-date outfit, embracing quick-warping steam windlass, stockless anchors, steam-steering gear amidships, and powerful screw-gear aft. The appliances for loading and discharging expeditiously are very complete, and include five 7 in. by 10 in. double-cylinder steam winches, steam being supplied from a Blake's patent vertical multitubular boiler. The engines will be of the triple-expansion type, by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, of about 1,100 I.H.P., having two steel boilers, 15 ft. by 10 ft., 160 lb. steam. The vessel has

been built to the order of Messrs. Thomas Middleton & Son, Hull. The christening ceremony was gracefully performed by Miss Middleton, daughter of the owner, who named the vessel *Blackfriargate*.

Dirphys.—On October 4th Messrs. William Gray & Co., Ltd., launched, at West Hartlepool, the handsome steel screw steamer *Dirphys*, which they have built for Messrs. The Navigation A Vapeur Panhellenique, Athens. She will take the highest class in Lloyd's, and is of the following dimensions, viz.: Length overall, 342 ft.; breadth, 47 ft. 6 in.; and depth, 28 ft. 6 in.; with extra long bridge, poop, and topgallant forecastle. The saloon, state-rooms, captain's, officers', and engineers' rooms will be fitted up in houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom, and fore and aft peak ballast tanks, six steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, horizontal multitubular donkey boiler on deck, shifting-boards throughout, stockless anchors, telescopic masts, with fore and aft rig, boats on beams overhead, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in., and 64 in. diameter, with a piston-stroke of 42-in., and two large steel boilers, for a working pressure of 180 lb. per square inch. The ship and machinery have been constructed under the personal superintendence of Mr. H. M. Rogers, on behalf of the owners, and the ceremony of christening the steamer *Dirphys* was gracefully performed by Mrs. H. M. Rogers, Bromley, Kent.

Steel Screw Steamer.—On October 4th there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Ltd., at Bill Quay, Newcastle-on-Tyne, a steel screw steamer, which has been built by them to the order of Mr. L. B. Rafen, of Holmestrand, Norway. The vessel is of the single-deck type, with poop, extended bridge, and topgallant forecastle, and is provided with cellular double bottom all fore and aft and after-peak tank for water ballast. She will be rigged as a two masted schooner, and will be fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo and general working and navigation. The saloon, captain's accommodation, &c., is arranged in a large steel deck house on the bridge deck, with chart-room on flying bridge above, the officers and engineers being berthed in side houses, also on bridge deck, and the crew in the topgallant forecastle. The engines, which have been constructed by Messrs. The North Eastern Marine Engineering Company, Ltd., of Wallsend, will be of the latest triple-expansion type, supplied with steam by two large steam multitubular boilers. Both the ship and engines have been built to Norske Veritas highest classification, and under the special survey of Mr. Lauritz M. Bodin, of Sunderland, the local representative of that society. The christening ceremony was gracefully performed by Mrs. James Skinner, of Westoe, South Shields. When completed, the vessel will be commanded by Captain Richard Tomte, of Holmestrand, Norway.

Hartland.—On October 16th Messrs. Richardson, Duck & Co. launched from their yard, at Stockton-on-Tees, a steel screw steamer of the following dimensions: Length, 383 ft.; breadth, 50 ft. 9 in.; depth (moulded), 30 ft. 3 in.; gross tonnage, about 4,750 tons; deadweight, about 8,000 tons on a moderate draught. This vessel has been built to the order of the Fargrove Steam Navigation Company, Ltd., of London (Messrs. Farrar, Groves & Co., managers), will class 100 A1 in Lloyd's Register, and has been built under special survey. She is a single-deck steamer, built to the three-deck rule, with poop, bridge, and topgallant forecastle. The hull and machinery have been constructed under the supervision of Mr. F. W. Bardens, superintendent engineer to the Fargrove Line. Accommodation for captain, officers, engineers, apprentices, &c., is provided in deckhouses on bridge deck, and for sailors and firemen in poop, which will be fitted with galvanised iron berths and bathroom. Winghouses, under topgallant forecastle, are fitted for carpenter's shop, separation cloth-room, paints, lamps, &c. Cellular double bottom throughout, and peak tanks, fitted for water ballast, and equipment includes seven steam winches, vertical donkey boiler, steam windlass, with quick-warping ends, stockless anchors, steam-steering gear, fresh-water condenser, and all the latest appliances for the economical and safe working of the vessel. The engines, by Messrs. Blair & Co., Ltd., have cylinders 26 in., 42 in., and 70 in., with a stroke of 48 in., steam being supplied by three single-ended boilers, having a working pressure of 180 lb. Wailes, Dove & Co.'s bitumastic enamels were applied to the boiler-room tank and lower bunkers, and their bitumastic covering to the tank top in boiler-rooom. As the vessel left the ways, she was christened *Hartland* by Miss Elsie Craven, of Stanhope-gardens, London, S.W. There were also present at the launch Mrs. James Groves, Mr. Havelock Groves, and other friends.

Ben Lomond.—On October 17th Messrs. William Gray & Co., Limited, launched, at West Hartlepool,, the handsome steel screw steamer *Ben Lomond*, which they have built for Messrs. John Morrison & Son, Newcastle. She will take the highest class in Lloyd's, and is of the following dimensions:—Length overall, 331 ft.; breadth, 45 ft. 9 in.; and depth, 23 ft. 6 in., with long bridge, poop, and topgallant forecastle. The saloon state-rooms, captain's, officers' and engineers' rooms, &c., will be fitted up in the houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom, and large aft peak ballast tank, six steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, stockless anchors, telescopic masts with fore and aft rig, boats on beams overhead, and all requirements for a first-class cargo steamer, including See's ash ejector, winch condenser, and special labour-saving appliances. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders', having cylinders 23½ in., 38 in., and 64 in. diameter, with a piston stroke of 42 in., and two large steel boilers, for a working pressure of 180 lb. per square inch. The ship and machinery have been constructed under the superintendence of Mr. Thomas A. Reed, M.I.N.A., Cardiff, on behalf of the owners, and the ceremony of christening the steamer *Ben Lomond* was gracefully performed by Mrs. J. W. Morrison, Corbridge, wife of one of the managing owners. There were present at the launch, among others, Mr. and Mrs. Samuel Morrison, Mr. J. W. Morrison, Mr. Allan and Miss Morrison, Mr. and Miss Clarke, and Mr. Weller.

Henrik Ibsen.—On October 18th Sir Raylton Dixon & Co., Limited, launched from their Cleveland Dockyards, Middlesbrough, a fine steel screw cargo steamer, built to the order of Herr Vilhelm Torkildsen, of Bergen, Norway. She is being built to Lloyd's spar-deck rule and Norwegian Veritas highest class, her principal dimensions being 396 ft. by 52 ft. 8½ in. by 28 ft. 4 in. (moulded), with a deadweight carrying capacity of 7,500 tons on a light draught of water. Her main, spar, poop decks, and bridge deck are of steel and iron, the latter being sheathed with wood in way of cabins and forecastle deck of pitch pine. Cabin accommodation will be fitted in two large steel houses on bridge deck, the forward one containing dining-saloon, state-room, captain's cabin, &c.; the after house, with accommodation for officers and engineers, while the sailors and firemen will be berthed under forecastle deck. A large chart and wheel-house is provided on top of saloon for navigating purposes. Water ballast will be carried in cellular double bottom, all fore and aft, and in fore and aft peaks, also in deep tank amidships. She is fitted with six watertight bulkheads, four boats, telescopic topmasts, five large hatchways, and will be equipped with nine powerful steam winches, steam windlass, ten derricks, &c., and all the latest and most modern appliances for the rapid handling of cargo. Triple-expansion engines will be fitted by the North-Eastern Marine Engineering Company, Limited, Wallsend, having cylinders 25 in., 41 in., and 67 in. by 45-in. stroke, supplied with steam by three large single-ended boilers, working at 180 lb. pressure. On leaving the ways she was gracefully named *Henrik Ibsen* by Miss Berven, of West Hartlepool. The vessel is being built under the superintendence of Captain Reinertsen, who will also command the steamer when completed.

Linda Fell.—On October 18th Messrs. Irvine's Shipbuilding and Dry Docks Company, Limited, launched from their shipyard a finely modelled steel screw steamer, built to the order of Messrs. The Hessler Shipping Company, Limited, West Hartlepool. She is of the following dimensions:—336 ft. by 47 ft. by 24 ft. 10 in. The vessel is built to Lloyd's highest class, under special survey, and is of the single deck type, having poop, bridge, and topgallant forecastle. A double bottom is fitted throughout on the cellular principle, and the fore and after peak tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stringers, giving clear holds for the storing of bulky

cargoes. Five watertight bulkheads divide the holds into six watertight compartments, and wood grain divisions are fitted in the holds. She also has extra large hatches, steam winches, which are supplied with steam from a vertical multitubular donkey boiler, and is replete with all the latest improvement for rapid loading and discharging. A powerful quick-warping steam windlass is fitted forward for the working of the cables, and steam-steering gear is fitted amidships, with hand-screw gear aft. Accommodation for captain and officers is arranged in houses on the bridge and the seamen and firemen under topgallant forecastle. The sanitary, ventilating, and lighting arrangements have received special attention, and have been effected on the most approved lines. Triple-expansion engines are being supplied by Messrs. Richardsons, Westgarth & Co., Limited, Hartlepool, having cylinders 24 in., 38 in., 64 in. by 42-in. stroke; two large single-ended boilers, 160 lb. pressure. Amongst those present at the launch were Mr. and Mrs. Jacob Hessler, Miss Daisy and Miss Signe Hessler, Sir Christopher Furness, M.P., Mr. Marmaduke Furness, J.P., Mr. A. S. Purdon, J.P., and Mr. J. T. Harris. As the vessel left the ways the christening ceremony was gracefully performed by Miss Daisy Hessler, who named the vessel *Linda Fell*.

Volante.—On October 18th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 127 ft. by 22 ft. by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Messrs. The Atlas Steam Fishing Company, Limited, of Grimsby, and will be fitted with powerful triple-expansion engines, by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Volante* by Mrs. William Letten, of Grimsby, wife of Mr. William Letten, managing director of the company, after which the company adjourned to the builders' offices, where breakfast was served, and the customary toasts given and responded to.

Cargo Steamer.—On October 18th there was launched from the Southwick Yard of Messrs. Robert Thompson & Sons, Ltd., a single-decked cargo steamer for Messrs. A. F. Klaveness & Co., of Sandefjord, Norway. Her principal dimensions are: Length (between perpendiculars), 346 ft. 6 in.; breadth (extreme), 50 ft. 10 in.; depth (moulded), 25 ft. 6 in.; and she is designed to carry a deadweight cargo on a light draught of water. She will be classed at Lloyd's 100 A1, under special survey, and is built under the three-deck rule, with single deck, having clear holds for facilitating the stowage of cargo. The vessel is fitted with full poop, cargo bridge, and topgallant forecastle, with accommodation for petty officers and crew. Large houses are built on the bridge for the accommodation of the captain, officers, and engineers, the saloon being fitted up in polished oak. Ample water-ballast space is provided in the cellular double bottom and fore and after peaks, the double bottom being subdivided both athwartships and longitudinally for trimming purposes. There are five large cargo hatchways, with double derricks, fitted on tables and cross-trees, worked by eight powerful steam winches, and extra large donkey boiler, for rapid loading and discharging of cargo. The vessel is being fitted with the most modern improvements for a first-class cargo steamer. The engines and boilers are by Messrs. John Dickinson & Sons, Ltd., having cylinders 25 in., 41 in., and 67 in., with a stroke of 45 in., with large boilers working at 180 lb. pressure. During construction the vessel, with her machinery, has been under the personal supervision of Mr. A. Nicol, of Sunderland.

Spider.—On October 20th there was launched from the yard of Earle's Shipbuilding and Engineering Company, Ltd., Hull, the *Spider*, a handsomely modelled steam trawler, built to the order of the British Steam Trawling Company, Ltd., Hull. Her dimensions are: 131 ft. 8 in. by 22 ft. 1 in., by 12 ft. depth of hold. She has been built under Lloyd's survey, and is intended for the Iceland trade. She is fitted with a whaleback, specially constructed to encounter heavy weather, and to provide a shelter for deck hands forward. The machinery will consist of a set of triple expansion engines, with an extra large boiler. The whole is of the most up-to-date design, and strongly proportioned, everything which should lessen the cost of upkeep and efficiency, under ordinary working conditions, being provided for. The naming ceremony was performed by Miss Meta Frances Carre, and amongst others present were: Mr. George Bohn, Mrs. Bohn, Mr. J. W. Mills (Beverley), Councillor Robins, Mrs. Robins, Miss Grace Waddington, Captain Harold Rose, Mr. Henry Wakelin, Mr. T. Bell, Mr. A. W. Peacock, Mr. Norman Locking, and Mr. F. Somerscales (Earle's Company).

Ugadale.—On October 20th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being: 127 ft. by 22 ft., by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Messrs. The Union Steam Fishing Company, Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways, she was gracefully christened the *Ugadale* by Miss E. Letten, of Grimsby, daughter of Mr. G. S. Letten, secretary of the company, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

LAUNCHES—Scotch.

Roberto Nunez.—On October 5th the steam tug *Roberto Nunez* was launched from the Renfrew yard of Messrs. Lobnitz & Co. This tug is the second of two, which have been built to the order of Messrs. S. Pearson & Son, for the Tehuantepec National Railway Company. The vessel is 100 ft. long, by 20 ft. breadth, by 12 ft. depth (moulded), and is to be classed 100 A1 at Lloyd's, and is being built under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London, Liverpool, and Rotterdam. She is being fitted with very powerful towing-gear, and with electric light throughout, including projector of Suez Canal type, and a complete salvage pump installation. The propelling machinery, which is also being built by Messrs. Lobnitz & Co., will consist of triple-expansion engines, 13 in. by 22 in. and 35 in. by 27-in. stroke, taking steam from one boiler of ample size, working at a pressure of 160 lb. The vessel is also fitted for burning oil fuel, under the Flannery-Boyd system.

Argo.—On October 5th there was launched at Kelvinhaugh by Messrs. John Shearer & Sons, Ltd., a handsomely modelled steel screw steamer, 198 ft. by 30 ft. by 14 ft. 2 in. (moulded), to carry 1,000 tons. The vessel has been built to Lloyd's highest class to the order of Messrs. J. & P. Hutchison, Glasgow, for their French carrying trade, and she is fitted with all the latest modern improvements for efficient working. Messrs. Hutson & Sons, Ltd., Kelvinhaugh, are supplying triple-expansion engines, with boilers to work at a pressure of 200 lb. The vessel was named *Argo* by Miss Isabella Millar Munro, Glasgow.

Soutra.—On October 5th there was launched at Port Glasgow by the Clyde Shipbuilding and Engineering Company, Ltd., a steel screw steamer 315 ft. by 46 ft. by 23 ft. 6 in., 4,700 tons deadweight, for Messrs. Japp & Kirby, Liverpool. The vessel was named *Soutra*, and immediately thereafter was berthed in the company's dock to receive engines and boilers, which have also been constructed by the builders.

Scottish Monarch.—On October 10th there was launched at Port Glasgow by Messrs. Russell & Co. a steamer with a carrying capacity of 8,350 tons, which they have built for Messrs. Raeburn & Verel, Glasgow. Her dimensions are: Length, 400 ft.; breadth, 52 ft.; depth, 30 ft. The vessel, which was named *Scottish Monarch*, has been built to the highest class in the British Corporation. The machinery will be supplied by Messrs. David Rowan & Co., Glasgow.

Dundee.—On October 16th there was launched at Dundee by the Caledon Shipbuilding and Engineering Company, Ltd., the steamer *Dundee*, which they have constructed to the order of Messrs. R. A. & O. B. Mackay, Hamilton, Ontario. The vessel is specially designed for the grain trade on the Canadian Lakes, and is of the following dimensions: Length, 257 ft. overall; breadth, 43 ft. 3 in.; depth to spar deck, 26 ft. 6 in.; gross tonnage, 2,300. She is built to the highest class in the British Corporation Registry. Triple-expansion engines, constructed by the builders, will be placed aft.

Mary.—On October 17th there was launched at Dundee by the Dundee Shipbuilding Company, Ltd., a powerful trawler named *Mary*, built to the order of Messrs. J. H. Marr & Sons, Ltd., Fleetwood. The vessel is of 137 ft. in length. Triple-expansion engines are being fitted by the Shields Engineering and Dry Dock Company.

Ellesmere.—On October 18th there was launched at Port Glasgow by Messrs. A. Rodger & Co. a steamer named *Ellesmere*, of the following dimensions: Length, 245 ft.; breadth, 36 ft.; depth, 18 ft. 3 in.; and of 1,200 tons gross, with a carrying capacity of 2,100 tons. The steamer has been built to the order of Messrs. Herbert Watson & Co., Manchester, and is specially fitted up for the fruit trade. The machinery will be supplied by Messrs. Ross & Duncan, Govan.

Lanfranc.—On October 18th there was launched at Dundee by the Caledon Shipbuilding and Engineering Company, Ltd., the twin-screw Royal mail steamer *Lanfranc*, built to the order of the Booth Steamship Company, Ltd., for their South American trade. The dimensions of the vessel are: Length overall, 433 ft.; breadth, 52 ft.; depth to shelter deck, 38 ft.; and gross tonnage about 6,000. She is of the shelter deck type, with a spacious promenade deck for half the length amidships, and a boat deck. There is accommodation for 200 saloon and 350 third-class passengers. The vessel is fitted with triple-expansion engines, having cylinders 25 in., 43 in., and 68 in. diameter respectively, with a stroke of 48 in. The vessel was launched by Mrs. Charles Booth, jun., and named by Mrs. Frank Brocklehurst, both of Liverpool.

Adele.—On October 18th Messrs. Hawthorns & Co., Ltd., Leith, launched a finely modelled screw steam yacht of 350 tons Y.M. This vessel has been built to the order of Ernest A. Pearce, Esq., London, on behalf of Henry Dutton, Esq., Anlaby, Kapunda, South Australia, from the designs of Alfred H. Brown, naval architect, London. The vessel is fitted throughout in polished hardwood, and with all the latest appliances for a first-class vessel of her type, including electric light, searchlight, steam windlass and capstan, steam steering-gear, &c. As she left the ways, she was christened *Adele* by Mrs. Mundy, of London. Amongst those present at the launch were H. H. Dutton, Esq., son of the owner; Mr. and Mrs. Mundy, London; Mr. and Mrs. A. H. Brown; and Mr. Pearce.

Janeta.—On October 18th Messrs. Alexander Stephen & Sons, Ltd., Linthouse, launched another steamer for Messrs. Maclay & McIntyre, Glasgow. The vessel, which is named *Janeta*, has been built to Lloyd's 100 A1 Class, and her dimensions are: Length, 385 ft.; breadth, 50 ft.; and depth, 28 ft. 8 in. She has been designed to carry 7,000 tons deadweight, on a moderate draught of water, and is fitted for carrying a large quantity of water ballast in the double bottom and peak tanks. She is fitted throughout with electric light, and is fully equipped for the quick handling of cargo, and her 'tween-decks are specially designed for the reception of bulky goods. The machinery, which is also being constructed by Messrs. Stephen, consists of a set of triple-expansion engines, having cylinders 25 in., 41 in., and 67 in. in diameter, with a stroke of 48 in. Steam at 175 lb. pressure will be supplied by two large single-ended boilers, fitted with Howden's forced draught.

Belle of Scotland.—On October 19th there was launched at Old Kilpatrick by Messrs. Napier & Miller, Ltd., the steel screw steamer *Belle of Scotland*, which they have built to the order of Messrs. Crow, Rudolph & Co., Liverpool. The vessel has been built to the highest class under the British Corporation rules, and her principal dimensions are: Length (between perpendiculars), 400 ft.; breadth, 52 ft.; depth, 30 ft.; with a deadweight carrying capacity of about 8,300 tons. Water ballast has been arranged in cellular double bottom, also in the aft peak and in a large deep tank abaft the engine-room. The machinery, which is being supplied by Messrs. Dunsmuir & Jackson, Ltd., Govan, consists of triple-expansion engines, with cylinders 27 in., 44 in., and 73 in. diameter respectively, and a 48-in. stroke. There are two boilers of large size and a donkey boiler, and the vessel is expected to attain a speed of 11 knots loaded. The naming ceremony was performed by Mrs. Arthur Crow, of Bidston, Birkenhead.

Denbigh Hall.—On October 22nd Messrs. Barclay, Curle & Co., Ltd., launched from their Clydeholm Yard at Whiteinch a finely modelled cargo steamer for Messrs. The Ellerman Lines, Ltd. The new steamer, which is named the *Denbigh Hall*, is rigged as a two-masted schooner, with poop, bridge, and forecastle, and has been built in excess of the highest class of British Corporation rules, with a Board of Trade and a Suez Canal certificate. The principal dimensions are as follows: Length overall, 413 ft. 3 in.; breadth, 50 ft. 3 in.; depth, 32 ft. 3 in.; with a gross tonnage of 5,250. Total carrying capacity, in holds, about 9,030 tons measurement. Water ballast is fitted all fore and aft in the cellular double bottom. In addition, a large deep water-ballast tank is arranged immediately abaft engine-room bulkhead, with a capacity of 875 tons, making a total water-ballast capacity of 1,802 tons, enabling her to go to sea in safety with little or no cargo. A complete installation of electric light has been fitted throughout the vessel, and all the living rooms are heated by steam. The facilities for loading and discharging of cargo are very complete, including nine powerful winches, twelve derricks, and six hatches. A special feature of the vessel is that in the holds, keelsons and stringers have been dispensed with; and, as the decks are supported by girders, the minimum amount of obstruction has been obtained. The crew are housed under the forecastle; the officers and engineers are in a house on bridge deck, with captain and chart-room in a house on the top of bridge deck. The machinery consists of a set of triple-expansion engines, cylinders 24½ in., 42 in., 71½ in., with a stroke of 48 in. Two single-ended boilers, fitted with Howden's forced draught, with a working pressure of 215 lb. per square inch, and one single-ended auxiliary boiler, 10 ft. diameter by 10 ft. long. The engine-room outfit is unusually complete, with all auxiliary gear, including electric light plant, &c. The deck machinery consists of a powerful windlass on the forecastle deck, a steam-steering engine on the upper deck at the aft end of the bridge deck, and nine large winches.

Karnafuli No. 1.—On October 22nd Messrs. William Simons & Co., Ltd., launched from their yard the twin-screw stern-well combined bucket and pump reclamation hopper dredger *Karnafuli No. 1*, constructed to the order of the Chittagong Port Trust, for the improvement of the harbour works at that port. The dredger has been constructed under the direction of Mr. James R. Bell, M.Inst.C.E., London, consulting engineer to the owners, assisted by Mr. John Bottomley, Altrincham. Launched complete and ready for work, the *Karnafuli* is replete with all the latest and most modern requirements for the special nature of the work to be done at Chittagong. The bucket ladder, built of the best form of girder work, is designed to dredge to a depth of 35 ft. below water-level. The nominal dredging capacity of the buckets is 800 tons per hour. The suction and discharge pumps are capable of raising and discharging 1,000 tons of material per hour. These pumps, each driven by independent engines, are arranged either to discharge their dredgings direct ashore for land reclamation, or, in conjunction with the builders' patent overside discharge, to deposit the contents of the hopper on shore, through the medium of a long length of delivery pipe. The vessel is propelled by two sets of compound surface-condensing engines of sufficient power to give a speed of 9 knots per hour when loaded. Steam is supplied by two large marine multitubular steel boilers, constructed for a working pressure of 120 lb. per square inch. Either set of propelling engines is available for driving the bucket dredging-gear, and change-gear is provided so that a constant piston speed can be maintained and the full power of the engines exerted, whether the dredger is working in hard or soft materials. The suction pipes, one on each side, are arranged for dredging while the dredger is being slowly propelled ahead. The dredger is provided with three independent sets of steam hoist-gear for controlling the bucket ladder and suction pipes. Powerful manœuvring winches are fitted forward and aft for regulating the operations of the dredger. A complete set of auxiliary pumps are fitted up in engine-room, and a donkey boiler is also fitted on board for supplying steam to the auxiliary machinery when the main boilers are at rest. The dredger is electrically lighted throughout.

LAUNCHES—Irish.

Howth Head.—On October 4th Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their South yard the steel screw steamer *Howth Head*, built to the order of the Ulster Steamship Co., Ltd., Belfast (Messrs. C. Heyn & Sons, managers). This is the seventh steamer built by Messrs. Workman, Clark & Co., for the Ulster SS. Co., who now own a fleet of sixteen high-class cargo steamers, forming the Head Line—thirteen of which have been built in Belfast, and all engaged in the regular lines worked by the company — New Orleans, Galveston, Montreal and Quebec, St. John's, N.B., and also Baltic ports, all to

Belfast and Dublin. The principal dimensions of the ss. *Howth Head* are: Length, 394 ft. 6 in.; breadth, 48 ft. 2 in.; depth, 31 ft. 6 in.; about 5,000 tons gross register, with a carrying capacity of upwards of 7,600 tons. The vessel will be classed 100 A1 at Lloyds under special survey, with Machinery Certificate, and has been built to the three-deck rule, considerably in excess of Lloyd's requirements, and also complies with the Board of Trade regulations for a first-class cargo steamer. The deck erections consist of poop, topgallant forecastle, and long bridge amidships; on the latter are placed steel deckhouses for the accommodation of a few passengers, captain, officers, and engineers, with chart and wheel house on the flying bridge. The vessel is subdivided into eight watertight compartments, the cargo holds being all of about equal capacity. The outfit for working cargo is very complete, and includes double derricks throughout, ten steam winches by the builders, fitted with the company's specialities for rapid handling of cargo. Ss. *Howth Head* is built on the cellular double-bottom principle, which, while adding to the safety of the vessel, gives ample water ballast for winter passages across the Atlantic without cargo, and, in addition, there is a large tank of 900 tons capacity abaft of the engine space arranged for either water ballast or cargo. The vessel will be rigged as a two-masted fore and aft schooner, the lower masts of steel, with pole masts arranged on the telescopic principle. The deck machinery is all up-to-date, including patent windlass by Messrs. Clarke, Chapman & Co., latest design with quick-warping ends; steam-steering gear by the Harrison Steering Engine Co., with patent spring tiller, all placed in large steering house in the poop. All the deck machinery is fitted with return and exhaust pipes into an auxiliary service condenser. The steamer will be fitted throughout with complete installation of electric light, including powerful arc lamps for deck use, by Messrs. J. H. Holmes & Co., and will also have the most improved system of steam fire-extinguishers fitted to each compartment to ensure safety in carrying cotton cargoes, &c.; also latest type of Lord Kelvin compasses and sounding machine. After the launch, the vessel was towed to the finishing berth to receive her machinery, which has also been constructed by Messrs. Workman, Clark & Co., Ltd., at their Engine Works, Queen's-road, Belfast, and consists of triple-expansion engines, steam being supplied from three large single-ended boilers, all fitted with Howden's system of forced draught. The shafting is of special steel, press forged, largely in excess of Lloyd's rules; propeller of manganese bronze, and auxiliary machinery to very full specification, of all latest and most improved type, including Weir's pumps, and evaporator, and special feed heater. The hull and machinery have been constructed under the supervision of Mr. Hugh Wisnom, superintendent engineer to the Head Line. The ss. *Howth Head* is intended to leave Belfast next month for New Orleans, to take her place on the Head Line service, and during the summer will be employed in the company's Canadian trade from Montreal and Quebec to Belfast and Dublin.

Aburi.—On October 18th Messrs. Harland & Wolff launched from Queen's Island the fine steel screw steamer *Aburi*, for the African Steamship Company (managing agents, Messrs. Elder, Dempster & Co.), for their West Coast service. The vessel is 370 ft. long, by 49 ft. beam, and about 4,000 tons gross, and has been built to Class 100 A1 at Lloyd's, under special survey. The *Aburi* will have superior accommodation for first and second-class passengers, with smoke-room and saloon; she will have a large deadweight carrying capacity on a light draught, and the arrangements for working the ship and cargo will be of the most complete kind, a special feature being the number of powerful derricks and winches at each hatch. The engines will be triple-expansion, and the vessel will have electric light throughout. The owners were represented at the launch by Mr. Campbell.

LAUNCH—Belgium.

Djerv.—On October 18th the Chantiers Navals Anversois launched successfully from their yard at Hoboken the finely modelled steamer *Djerv*, built to the order of Mr. Andreas Gjersoe, Trondhjem (Norway). The vessel, which is a superior steamer of 2,600 tons deadweight, has been built under Lloyd's supervision as well as Norwegian Veritas to highest class in these respective societies. She is of the poop, bridge, and forecastle type, built to two-deck rule, and is 255 ft. long by 36 ft. beam, and 20 ft. 6 in. deep, having a draught when loaded of 17 ft. 6 in., and will be fitted with triple-expansion engines, diameter of cylinders 19 in., 31 in., 51 in., by 36-in. stroke, the steam being supplied by two single-ended boilers, 12 ft. 6 in. in diameter by 10 ft. 6 in., working at 180 lb. pressure per square inch. The deck outfit is exceptionally complete, comprising powerful steam windlass with quick-warping ends, five steam winches working large hatchways, and steam-steering engine. Two derrick-posts are fitted on poop, and gaffs aloft on masts for discharging, as well as the usual derricks on masts. The crew are berthed forward, and the officers and engineers amidships, in houses on bridge deck, this accommodation being steam-heated, special precautions having been taken to ensure the comfort of those on board in this and all other respects. The holds are all clear, deep framing having been adopted to this end. The vessel is now being engined, and will be completed in about three weeks.

TRIAL TRIPS.

Oceana.—On September 22nd the large screw cargo steamer *Oceana* (of which we gave particulars in our September issue, page 67), built and engined by Messrs. David and William Henderson & Co., Ltd., Partick, to the order of Messrs. Maclay & McIntyre, of Glasgow, underwent a successful trial trip in the Firth of Clyde. Everything passed off satisfactorily, and a mean speed of 12½ knots was easily attained.

Harlyn.—On September 24th the handsome steel screw steamer *Harlyn* (of which we gave particulars in our September issue, page 65), was taken from the yard of Messrs. William Gray & Co., Ltd., for her trial trip. She has been engined from the Central Marine Engine Works of the builders, and built to the order of Messrs. J. & C. Harrison, Ltd., of London. On a prolonged run of about 45 miles, the average speed of the vessel was 11¼ knots, the performance of the ship and engines meanwhile giving the utmost satisfaction.

Goslar.—On September 29th the steamer *Goslar* (of which we gave particulars in our September issue, page 65), built and engined by Messrs. Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works, went for a very successful trial trip off the coast, attaining a speed of 12½ knots per hour, when the engines worked without the slightest hitch. The owners, the Deutsch-Australische D. G., of Hamburg, were represented on the trial trip by Mr. Harms, the managing director of the company.

Skogland.—On September 29th the handsome steel screw steamer *Skogland* (of which we gave particulars in our October issue, page 97), built by Messrs. William Gray & Co., Ltd., and engined at the Central Marine Engine Works of the builders, for Messrs. C. A. Forslind & Son, of West Hartlepool, had her trial trip. A run was made along the coast to Tynemouth and back, during which the performance of the ship and engines gave every satisfaction, the average speed over the whole run being 12 knots.

Star of Japan.—On October 2nd the above vessel (of which we gave particulars in our September issue, page 68), built and engined by Messrs. Workman, Clark & Co., Ltd., to the order of Messrs. J. P. Corry & Co., of London, left the Milewater Wharf, and proceeded down Belfast Lough for adjustment of compasses and speed trials prior to her departure for London, calling at Barry for bunker coal *en route*. The construction of the vessel and machinery has been supervised by Mr. Alexander Macdonald, the representative for Messrs. Corry & Co.

Steam Tug.—On October 5th a steam tug, built by Mr. Edward Hayes, Watling Works, Stony Stratford, ran her trial trip on the Thames with very good results, her guaranteed speed being 11 miles per hour, but she made considerably over this. Her length is 51 ft.; width, 11 ft.; draught, about 4 ft. She is fitted with their standard compound surface-condensing engines, having cylinders 8 in. by 16 in. diameter, and 10-in. stroke; steam is supplied at 120 lb. pressure by a marine return-tube boiler of ample size. She has a comfortable cabin forward, and a store-room aft; all her fittings, such as companion, skylights, and pulpit, are of teak, highly finished and strongly constructed. She is going out to South America on export steamer's deck, the

boiler being first removed and put in the hold; she is specially constructed for this. Purchasers are Messrs. Dussault, Chavil & Co., of Birmingham.

Lady Furness.—On October 9th the screw steamer *Lady Furness* (of which we gave particulars in our October issue, page 98), built by the Blyth Shipbuilding Company, Limited, and engined by the North-Eastern Marine Engineering Company, Limited, Wallsend, to the order of Messrs. Furness, Withy & Co., Limited, for Messrs. The International Steamship and Salvage Company, Limited, of Copenhagen, was taken to sea for trial. The owners, builders and engineers were represented by Mr. A. H. Walker, Mr. G. Moffitt, and Mr. Wimbel, and on the run over the measured mile a highly satisfactory speed was made, the engines working smoothly throughout.

Halfdan.—On October 12th the new steamer *Halfdan* (of which we gave particulars in our October issue, page 99), built by the Sunderland Shipbuilding Company, Limited, and engined by the North Eastern Marine Engineering Company, Limited, Sunderland, was taken to sea upon her official trial. The vessel has been built to the order of Aktieselskabet Dampskibsselskabet Skjold, Copenhagen, and, constructed under the superintendence of Mr. Kaempe and Captain Christian L. Hansen. During the trial trip everything worked in a most satisfactory manner.

Millpool. On October 12th the ss. *Millpool* (of which we gave particulars in our October issue, page 97), built by Messrs. Ropner & Son, of Stockton-on Tees, and engined by Messrs. Blair & Co., Limited, Stockton on Tees, made her official trial trip in the Tees Bay. The steamer has been built to the order of Messrs. The Pool Shipping Company, West Hartlepool (Messrs. R. Ropner & Co., managers) and is fitted with the builders' patent improved trunk deck. After a very successful trial trip, during which a speed of 11 knots was attained, the steamer proceeded to New Orleans. The company on board included Mr. Nicholson, the owners' superintendent, Captain Owen, the commander of the vessel, and Mr. J. R. Garthwaite, who was in attendance on behalf of the builders.

Toftwood. On October 12th the large steel screw steamer *Toftwood* (of which we gave particulars in our launch columns), built by R. Craggs & Sons, Limited, Tees Dock yard, Middlesbrough, and engined by Messrs. Blair & Co., Limited, Stockton-on Tees, for Messrs. Constantine & Pickering Steamship Company, of Middlesbrough, proceeded to sea for her official trials. The results were pronounced entirely satisfactory to all concerned, the vessel registering a speed of 11¾ knots.

Kaiapoi.—On October 13th Messrs. Osbourne, Graham & Co., of Hylton, Sunderland, sent the steel screw steamer *Kaiapoi* for her official trial. This steamer has been specially built to the order of the Union Steamship Company of New Zealand, Limited, New Zealand, and is built on the single-deck principle, with deep bulb angle frames, to the highest class at Lloyd's. She has poop, bridge and forecastle, large self-trimming hatches, and will carry 3,150 tons on about 18 ft. draught. The accommodation for officers is fitted up in the poop, and the engineers and captain are fitted up in commodious houses on the bridge—all in compliance with the New Zealand regulations. Facilities for handling cargo are very complete, there being sixteen derricks, worked by eight large winches, manufactured by Messrs. Clarke, Chapman & Co., Limited, of Gateshead. Steam windlass is of Clarke Chapman's special type, and the steam-steering gear is by Messrs. Lynn & Co., Ltd., of Sunderland. The engines and boilers are by the North-Eastern Marine Engineering Company, Limited, of Sunderland, and are of ample size to drive the vessel 10 knots, loaded. After a most satisfactory trial trip the steamer proceeded on her first voyage, loaded with coal for New Zealand.

Wangard.—On October 17th the fine steel screw steamer *Wangard* (of which we gave particulars in our September issue, page 65), built by the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, and engined by Richardsons, Westgarth & Co., Ltd., Sunderland, to the order of Messrs. The Midgard Deutsche Seeverkehrs Aktiengesellschaft, of Bremen, left the Tyne for her trial trip, it being the third vessel built by the Northumberland Shipbuilding Company, Limited, for this company, who have two other vessels at present building for the same owners. The vessel during the period of construction has been under the supervision of Mr. G. Bahr and Mr. H. Reike. Mr. Deitrich has supervised the construction of the engines and boilers on behalf of the owners. The trial trip proved in every way satisfactory, and a speed of 11 knots was easily obtained. The vessel afterwards proceeded to Bremen, under the command of Captain Bruhn. Among the guests on board were the following: Mr. G. Bahr, representing the owners, Mr. J. Graham and Mr. G. E. Conner, representing the builders, and Mr. A. Harrison, representing the engineers.

Sandon Hall.—On October 18th the ss. *Sandon Hall* (of which we gave particulars in our October issue, page 98), built by Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, and engined by the Wallsend Slipway and Engineering Company, Ltd., for the Hall Line service of the Ellerman Lines, Ltd., was taken out to sea, for her trial trip, which gave entire satisfaction. The speed attained was 12½ knots. During the construction the vessel has been under the superintendence of Mr. Alexander Dalrymple and Captain Forster, who were present on the trial trip.

Veraston.—On October 18th the handsome steel screw steamer *Veraston* (of which we gave particulars in our October issue, page 100), built by Messrs. William Gray & Co., Ltd., and engined at the Central Marine Engine Works of the builders, for Messrs. Walter Scott & Co., of West Hartlepool, was taken to sea for her trial trip. After adjustment of compasses, the vessel was headed for the north, and made a run along the coast with the engines fully opened out, when a speed of 10½ knots was averaged, everything in ship and engine departments giving entire satisfaction. The vessel afterwards proceeded to Swansea to load.

Apollo. On October 20th the steel screw steamer *Apollo*, built for the Bristol Steam Navigation Company, Ltd., Bristol, by the Campbeltown Shipbuilding Company, Campbeltown, went down the river for her trial trip. The vessel is about 3,500 tons deadweight, and is a single-decker vessel, with poop, bridge, and forecastle. She has eleven winches and derricks for rapid discharge of cargo, and is the seventh vessel built by the builders for the Bristol Company. The machinery consists of triple expansion engines, supplied with steam from two large boilers, working at 180 lb. pressure, and has been built by Messrs. D. Rowan & Co. On the trial everything was satisfactory, and a speed of 13 knots was attained.

Glamorgan.—On October 20th the steel screw steamer *Glamorgan* (of which we gave particulars in our October issue, page 99), built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, and engined by Messrs. John Dickinson & Sons, Ltd., Sunderland, to the order of Messrs. Jenkins Brothers, of Cardiff, was taken to sea for her trial trip, which proved highly satisfactory, a speed of 11½ knots being maintained. The owners were represented by Captain David Jenkins, of Messrs. Jenkins Brothers, Cardiff, and Mr. Appleton superintendent engineer), of Cardiff, both of whom expressed themselves as being highly pleased with the ship and engines. The shipbuilders were represented by Mr. Herbert Taylor, and the engineers by Mr. Bowden. After the trial trip the vessel proceeded to Barry Dock, Cardiff, to load, under command of Captain J. Davies.

Tangistan.—On October 20th Messrs. William Gray & Co., Ltd., sent to sea the large steel screw steamer *Tangistan* (of which we gave particulars in our October issue, page 99), which they have just completed for Messrs. Frank C. Strick & Co., Ltd., of Swansea and London. The machinery has been made at the Central Marine Engine Works of the builders. The vessel and her machinery have been constructed under the superintendence of Mr. Archibald Walker, of London, and that gentleman represented the owners on the trial trip, Captain C. D. Sadler being in command of the vessel. The shipbuilders were represented by Captain J. E. Murrell, and the engine builders by Mr. William Reynard. The mean speed on the double run to the Tyne and back was 12 knots, and the performance of ship and engines entirely satisfactory. After disembarking her visitors, the vessel proceeded on her voyage to Antwerp to load.

Ellerslie.—On October 22nd the new screw steamer *Ellerslie* (of which we gave particulars in our October issue, page 99), built and engined by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of Messrs. Hutchins Brothers, Cardiff, was taken to sea on her official trial trip, which was in every way successful and satisfactory to all concerned, a mean speed of over 11 knots being attained. Among the company present were Mr. Marquand, representing the owners, Mr. James Readhead, and Mr.

John Readhead. The vessel proceeded to a Bristol Channel port to load for the River Plate.

Harley.—On October 22nd the official trial trip of the ss. *Harley* (of which we gave particulars in our October issue, page 97), was successfully carried out off Hartlepool, a speed of 12 knots being easily attained. The machinery worked smoothly throughout the trial. Mr. Crandell, superintendent, was present on behalf of the owners, Messrs. J. & C. Harrison, Ltd., London, and Messrs. Bolton & Parker for the builders, Messrs. Furness, Withy & Co., Mr. Urquhart representing the engineers, Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool. The vessel afterwards proceeded to Barry to load.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C denotes First Class; 2C Second Class.

September 22nd, 1906.

Anderson, F. W. 2C Glasgow
Anderson, R. .. 1C Glasgow
Banks, T. K. ... 2C South'ton
Barnett T. R. ... 2C N. Shields
Burr, Bert F. ... 2C Liverpool
Carman, F. N.... 1C N.Shields
Chinchin, P. J... 2C South'ton
Cleary, John ... 2C Liverpool
Coates, C. R. ... 1C W. Hart'l
Collins, Edgar... 2C London
Dalrymple F. S.. 2C London
Daniel, W. W. ... 2C London
Day, George ... 2C Cardiff
Dempster, T. W. 1C Leith
Dennis, William 2C Glasgow
Dobson, W. E.... 1C W. Hart'l
Downie, Peter... 2C Glasgow
Evans, Thomas.. 2C Cardiff
Ferguson, A. ... 1C Glasgow
Gibson. C. E. ... 1C Barrow
Gothe, Otto G.... 2C W. Hart'l
Gourlay A. J. ... 2C Leith
Griffiths, T. J. ... 2C Cardiff
Hargrave, E. ... 2C Cardiff
Harvey, Ralph... 2C South'ton
Hornsey, Oscar.. 2C W. Hart'l
Hughes, F. W... 2C W. Hart'l
Humble, R. H... 1C W. Hart'l
Jones, Percy B.. 1C Cardiff
Jude, James ... 1C Leith
Legg, John G. ... 2C Liverpool
Lewis William... 1C Cardiff
Mackintosh, W.A. 1C Glasgow
Marr, Arthur G.. 2C Leith
M'Kinley, Robert 2C Glasgow
M'Neil, W. B ... 2C London
Moule, Harold... 2C N. Shields
Murray, Robert. 1C Liverpool
Napier, William 1C Glasgow
Nicholls, W. ... 1C Cardiff
Ord, George H... 1C N.Shields
Peddie, John ... 1C Liverpool
Pringle, A. E.... 1C Cardiff
Purvis, W. M ... 2C London
Reily, Ernest E. 2C Liverpool
Ring, Edward G. 1C W. Hart'l
Rose, B. J. C. ... 2C London
Skinner, F. L. ... 2C Cardiff
Smibert, J. C. ... 2C Leith
Stark, G. ... 2C Liverpool
Tapper, G. V. ... 2C London
Tee, Ernest A. ... 2C South'ton
Thomson, A. ... 1C Leith
Thirkill, E. ... 1C W. Hart'l
Treld, John ... 2C W. Hart'l
Tyson, G. D. ... 1C Liverpool
Walker, H. ... 1C Glasgow
Walsh, D. J. ... 2C Liverpool
Watson, G. ... 1C Glasgow
Weeniuk, H. ... 2C London
Willis, J. T. ... 1C Liverpool

September 29th.

Adams. S. A. ... 1C N.Shields
Barker, R. N. ... 1C Liverpool
Blair, T. A. ... 2C Liverpool
Burke, Fred. ... 1C Hull
Cass, F. W. ... 2C London
Coppock, F. S. ... 1C Bristol
Cowell, Alfred .. 2C London
Crute, E. ... ... 2C Sunderl'd
Dennis, H. D. ... 2C Sunderl'd
Dickinson, W. E. 1C Hull
Dunkerley, T. E. 1C N. Shields
Gittos, W. H. ... 2C Greenock
Gray, John ... 2C Liverpool
Hart, E. J. ... 1C Bristol
Heron, Thomas... 2C N. Shields
I'Anson, E. W.G 1C N.Shields
Jowett, Harry ... 1C Hull
Keenan, C. McG.. 1C London
Kennedy, P. ... 2C Aberdeen
Kinghorn, T. ... 2C N. Shields
Lavender, T. F. . 1C Liverpool
Lawson, V. O. ... 2C Bristol
Lowdon. Ivor L. 2C Bristol
Manger, E. C. ... 1C London
Marshall, E. W. 1C Hull
Melbye, James ... 2C Greenock
Morgan, J. H. ... 1C Greenock
Nelson, W. M. ... 2C Liverpool
Norledge. G. V. ... 1C Liverpool
Paget, William... 2C N. Shields
Percival, Peter.. 2C Liverpool
Ravenburn, F.... 2C N. Shields
Rewcastle. W. T. 2C N. Shields
Seville, Harold . 2C Liverpool
Shearer, G. H.... 2C Liverpool
Street, B. H. ... 2C Hull
Thom, Alex. ... 2C Aberdeen
Wallace, R. G ... 2C Liverpool
Watt, James ... 1C Aberdeen
Wishart, W. A. 2C Aberdeen

October 6th.

Baseley, R. B. ... 1C Liverpool
Bender. James T. 1C N. Shields
Berry, Richard 1C Liverpool
Bucknell, F. R. 1C London
Candy, Clifford J. 1C South'ton
Creighton, E. H. 2C Belfast
Cumming, A. M'G. 1C Glasgow
Cusworth. G. E. 2C Cardiff
Davison, J. H.... 1C N. Shields
Douglas, D. C. A. 2C Leith
Drysdale, J. H. .. 1C Leith
Earnshaw, J. ... 1C N. Shields
Edwards, Fred 2C Cardiff
Fentiman, H. J. 2C N. Shields
Gendall, Richard 2C Falmouth
Goodall, Lester 2C Liverpool
Hall, Richard L. 2C N. Shields
Hirschman, T. 2C Liverpool
Hobson, W..... 1C South'ton
Holland, G. I... 2C Cardiff
Hopkins. J. B. 1C Glasgow
Jones, T. E. ... 1C Cardiff
Kemp, Alexander 2C Liverpool
Ketley. Harry E. 2C London
Kirkpatrick, S. 1C Leith
Lilly, H. Le M. 2C Glasgow
Marshall, C. ... 1C Glasgow
Mearns, Henry 1C Belfast
M'Faddin, W.... 2C Cardiff
Mitchell, W. ... 1C Leith
M'Kay, Samuel 2C Belfast
M'Kenzie, J. ... 2C Glasgow
M'Lean, D. D. 2C Liverpool
M'Niven, George 1C Glasgow
Morris, Walter S. 1C London
Morrison, James 2C Glasgow
Morrison, K. ... 1C Glasgow
Munro, Gillies... 1C Glasgow
Pawley, R. J. ... 2C Cardiff
Peel, John B. ... 1C N. Shields
Pemberton, S. I. 2C Cardiff
Price, Thomas ... 1C Liverpool
Ramsey, D. J. ... 1C South'ton
Sibbald, W. ... 2C Glasgow
Skeoch, W. J. ... 1C Glasgow
Smiles, W. I. ... 1C N. Shields
Smith, John K.. 2C N. Shields
Stewart, A. G.... 1C South'ton
Wallis, T. S. ... 2C South'ton
Wheeler, H. B. . 2C South'ton
Willock, D. B. . 1C Glasgow

October 13th.

Blyth, Henry ... 2C Hull
Bradley, C. L. ... 2C N. Shields
Derbridge, H. S. 1C London
Doloughan, J. ... 2C Liverpool
Fenwick, R. C.... 2C N. Shields
Hegarthy, D. A. 2C Greenock
Hirschman, J. ... 1C Liverpool
Jones, Frank ... 1C Dublin
Lockley, Robert 1C London
Lowe, Robert S.. 2C Dundee
Mansergh, W. ... 2C Liverpool
May, Bernard ... 2C Liverpool
Meyer, W. J. ... 2C London
Ogilvie, Allan J. 2C Greenock
Rice, Arthur E.. 2C London
Richards, P. B... 1C Dublin
Ritchie, W. S.... 2C Dundee
Rogers, Bertie... 1C Liverpool
Smyth A. R. ... 2C London
Thom, Robert ... 2C Greenock
Warriner, David 2C Liverpool
Watson, S. ... 2C N. Shields
Whitby, W. D.. 1C Liverpool

October 20th.

Agnew, H. ... ... 2C London
Armstrong, G ... 2C Glasgow
Barr, W. ... ... 2C Glasgow
Booker, R. ... 1C Liverpool
Boston, Robert . 2C Glasgow
Boyd, William... 1C Southt'on
Coyle, James ... 2C Glasgow
Craig, Richard... 1C N. Shields
Cruikshank, J. S. 2C Leith
Dale, L. D. S. ... 2C London
Evans, E. R. ... 2C London
Evans, J. ... ... 1C Liverpool
Fawcett, S. C. ... 1C W. Hart'l
Ford, Thomas ... 3C Glasgow
Forsyth, A. Y. . 2C Leith
Fullerton, S. H.. 2C Glasgow
Goulden. H. L .. 2C Liverpool
Gunn, W. ... ... 2C Glasgow
Hall, J. B. ... 1C Liverpool
Harley, James ... 2C Glasgow
Kaye, William... 1C Glasgow
Keep, Charles ... 1C South'ton
Kinghorn, A. ... 1C Cardiff
Laing, W. ... 1C N. Shields
Lander, G. J. ... 2C Plymouth
Leaf, John N. ... 2C W.H'pool
Lowe, George ... 1C Leith
Macrosie, D. D. . 1C Leith
Maughan, C. E. . 2C W.H'pool
McDermott. T. H. 2C Liverpool
McIntosh, C. S. . 2C Leith
M'Neil, Frank ... 2C Cardiff
Pearse, F. P. ... 2C Liverpool
Peate, E. B. T. . 2C Liverpool
Quayle, W. ... 2C Liverpool
Read, Gordon ... 2C Cardiff
Reed, Frank B. . 2C Cardiff
Rogers, A.... ... 1C Liverpool
Saunders, W. H. 2C Cardiff
Sinclair. D. C.... 1C Glasgow
Smart, G. R. ... 2C Leith
Smeaton, G. A.... 2C Glasgow
Snowdon, J. C.... 1C W.H'pool
Stephen, T. McC. 2C Glasgow
Stewart, W. A. . 1C Glasgow
Thomas, Robert . 1C Liverpool
Trotter, Jacob F. 1C W.H'pool
Von Randow, H. 2C London
Wheeldon, H. B. 2C Cardiff
Whitwell, G. ... 1C Barrow
Wilkinson, J. A. 2C Cardiff

Messrs. Suter, Hartmann & Rahtjen's Composition Company, Ltd., have sent us a list of some of the vessels supplied by them during recent three months—total, 3,088,540 tons.

Messrs. Chadburn's (Ship) Telegraphs Company, Ltd., Liverpool, have received an intimation that the international jury at the Milan Exhibition have awarded them the grand prize for exhibits of ships' telegraphs.

Mr. Henry F. Joel informs us that he has changed his address from 31, Wilson-street, E.C., to 110, Strand, W.C., where he will practise as a consulting electrical engineer, and will be pleased, as heretofore, to place his services at the disposal of his clients.

The Stirling Boiler Company, Ltd., have received a gold medal at the Milan Exhibition in connection with the marine Stirling boiler they have installed, supplying steam for the requirements of the Exhibition. This boiler, capable of developing 280 H.P., is of a type specially designed for light-draught vessels, great attention being paid to keep the total weight as small as possible, and to that end the casing is lined with special fire-brick, which, besides being an efficient non-conductor, is very much lighter than ordinary fire-brick.

The Marine Engineer

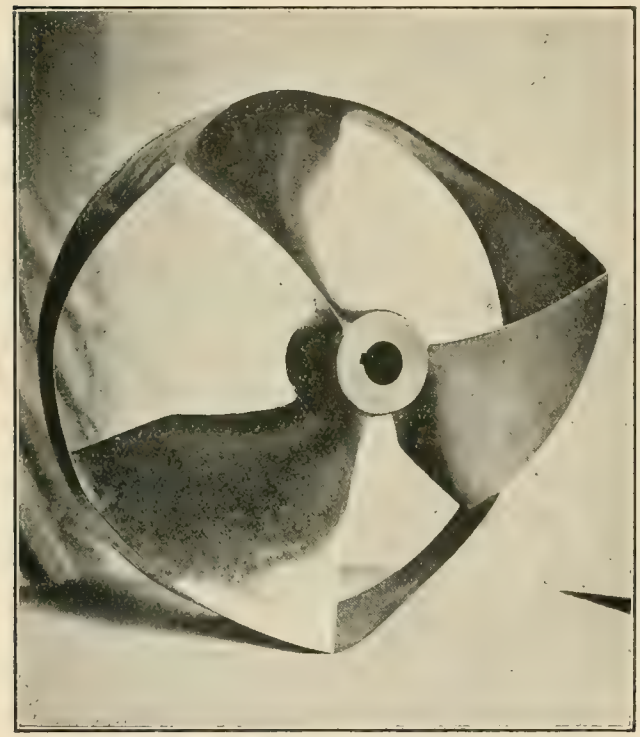
And Naval Architect.

LONDON, DECEMBER 1, 1906.

DURING the last twenty years Germany has made an enormous advance in shipbuilding, and, as a result, not only naval architects and shipbuilders, but all who are interested in shipping have made a note of the fact. Naturally, too, much has been written about the subject, until gradually public opinion has become so impressed that it is apt to accept even the most exaggerated statements of her capabilities in this direction. This is so, not merely with regard to commercial shipbuilding, shipbuilding for the mercantile marine, but also as regards warship construction. It has even been said in this latter connection, that as regards speed and cost of construction, this country no longer retains or possesses any sensible advantage as compared with Germany. There can hardly be a doubt that some of the alarm which has recently found expression in the Press concerning our supremacy afloat may be traced to allegations of this nature. Most timely, then, is the series of articles which Sir William White is contributing to the *Times* on "British and Foreign Warship Building Capability," of which the first appeared on November 15th. Not everyone possesses the technical knowledge and experience required for a thorough investigation of this subject in all its details and bearing; but if anyone is fitted for the task it is surely the eminent naval architect who from 1885 to 1902 held office as Director of Naval Construction and Assistant-Controller of the British Navy. In virtue of his long and varied experience, Sir William White is entitled to speak with absolute authority on this subject, and the public cannot fail to attach the very greatest importance to his declaration. The former Director of Naval Construction points in the first place to the fact that during the last twenty years no other country has passed through such a corresponding succession of great programmes of naval construction as this, and no other country can compare with the United Kingdom in its capacity for shipbuilding and marine engineering or for the manufacture of armour, guns, gun-mountings, and auxiliary machinery. That this has been, in a large measure, due to the enterprise of private firms encouraged by Government orders, but taking the inevitable risks of such enterprise, is unquestionable. In 1889 the Armstrong Company was practically the only firm making heavy guns and gun-mountings. But owing to the demand which then arose, Messrs. Whitworth developed this branch of manufacture. Messrs. Vickers followed, Messrs Beardmore have since taken up similar work, and at the present time the associated firms of John Brown, Cammell, Laird, and Fairfield are constructing great ordnance works at Coventry and on the Clyde. As a consequence, says Sir William White, the manufacturing capability of the country will be raised to as great a position as its armour-plate works reached four years ago. In addition, our resources in mechanical engineering, devoted to the production of special forms of auxiliary engines and machinery required in warships, are unrivalled and adequate to meet much greater demands than are likely to arise. As compared with this most advantageous position, Germany has at the present moment only one large armour-plate factory, and in other respects her resources in this connection do not compare with ours. "Taking things as they stand at present," Sir William White says, "it is probably near the truth to say that, whereas we could provide each year from existing resources armour, guns, and gun-mountings for ten or twelve first-class battleships, Germany would not be able to provide for more than four or five similar ships." This is the relative position to-day. But if we are to maintain our advantage, the Government must continue to give that stimulus to private enterprise, which has been such an important factor in the development of our unrivalled resources.

APROPOS to the papers which we are publishing upon the propeller, we must not omit to notice the paper read by Mr. W. Preidel on some propositions and proposals regarding screw propulsion before the Institute of Marine Engineers. He has given a good deal of attention and has been testing some of his theories on steam launches, and is well aware that there has been more controversy on screw propulsion than on any other engineering subject, but he does not wish to raise such controversy again, but to give what he considers to be certain conclusions at which he has arrived. First, with regard to the term "slip," either positive or negative, which is generally applied to propellers, he points out that "slip" was looked upon as a loss of efficiency for the screw, and that many screws were designed which had no slip at all. This, in such a case, should be the best form of propeller which could be used But ship-owners have found that with a propeller having positive slip a better means for propulsion was found then in the propellers with no slip. A proposition by Professor Rankine, which showed that a propeller with slip was necessary so as to obtain thrust of the water, was generally accepted, and is the fundamental principle of the propeller theory still. It must be remembered that a screw propeller merely rotates about its axis, consequently its line of action is at right angles to a straight line astern. So when the propeller rotates it presses on and eventually displaces the water between the blades to the axial or horizontal length and the respective diameters. The result of a propeller —that is the speed of a vessel for rotating energy—will depend upon how the propeller displaces its water and how the water can return to it, and these factors are of equal importance. It has generally been taken for granted that a screw can be easily fed if it is not put

behind a very blunt stern, but the question of cavitation may form some objections to this theory. To understand fully how a propeller imparts different velocities on different quantities, even with uniformly pitched blades, it must be remembered that the propeller acts in an axial plane and that most propellers have irregular shape in the axial plane and thus act respectively upon quite different portions of the column at different radii, and that the velocity imparted is not uniform throughout the whole of the water threads, for, if this were so, complete rupture between feed and discharged water would occur, or else the velocity of the feed water must be equal to that of the discharged water, in which case the propeller could not obtain forward thrust. As the author, Mr. Preidel states, water having motion imparted to it in any outward direction would leave in



Preidel's Screw Propeller.

the centre an empty space, but it generally happens that the water which escapes in a lateral direction is soon driven back by the surrounding pressure into the vacuum left by the blade, and thus the mean or residue of all motions will be directed astern. It is to this region where slip and feed take place alternately which is responsible for the propeller having to be suited to the hull and the class of work, and therefore makes it impossible for propellers to be standardised. It is to this region of the propeller that Mr. Preidel has devoted much attention with a view to obviating lateral slip. He therefore proposes the use of a propeller with a recessed circular ring. The recesses are in front from the leading edge of blade to somewhere near the trailing edge of the preceding blade, and the ring is to continue a little way complete behind the blades. He finds these propellers may be made from 10 per cent. to 30 per cent. smaller in the diameter, which would amply compensate for the skin friction of the ring, and these propellers he has tried with excellent results upon steam launches.

A NOVEL TRIPLE-SCREW STEAMER.

THE *Londres*, built by Messrs. Gourlay Bros. & Co., Ltd., of Dundee, is for passenger and goods river traffic on the River Plate. Hitherto all the steamers belonging to the same owners have been of the paddle type, owing to the shallow draught in the upper reaches of the river. It was desired, however, to get screw-propelled boats if the requisite light draught could be guaranteed.

At first turbines were thought of, but eventually reciprocating engines were designed. These engines are three sets, each having four cylinders working on four cranks, and driving three propellers. To ensure the running without vibration was an essential feature, and these engines on trial ran noiselessly at a speed of about 250 revolutions per minute. The working parts are all carefully balanced, and their lubrication is done mechanically under pressure, the effect being that the whole of the working parts are practically floating in oil, so that all knocking and vibration are dispensed with.

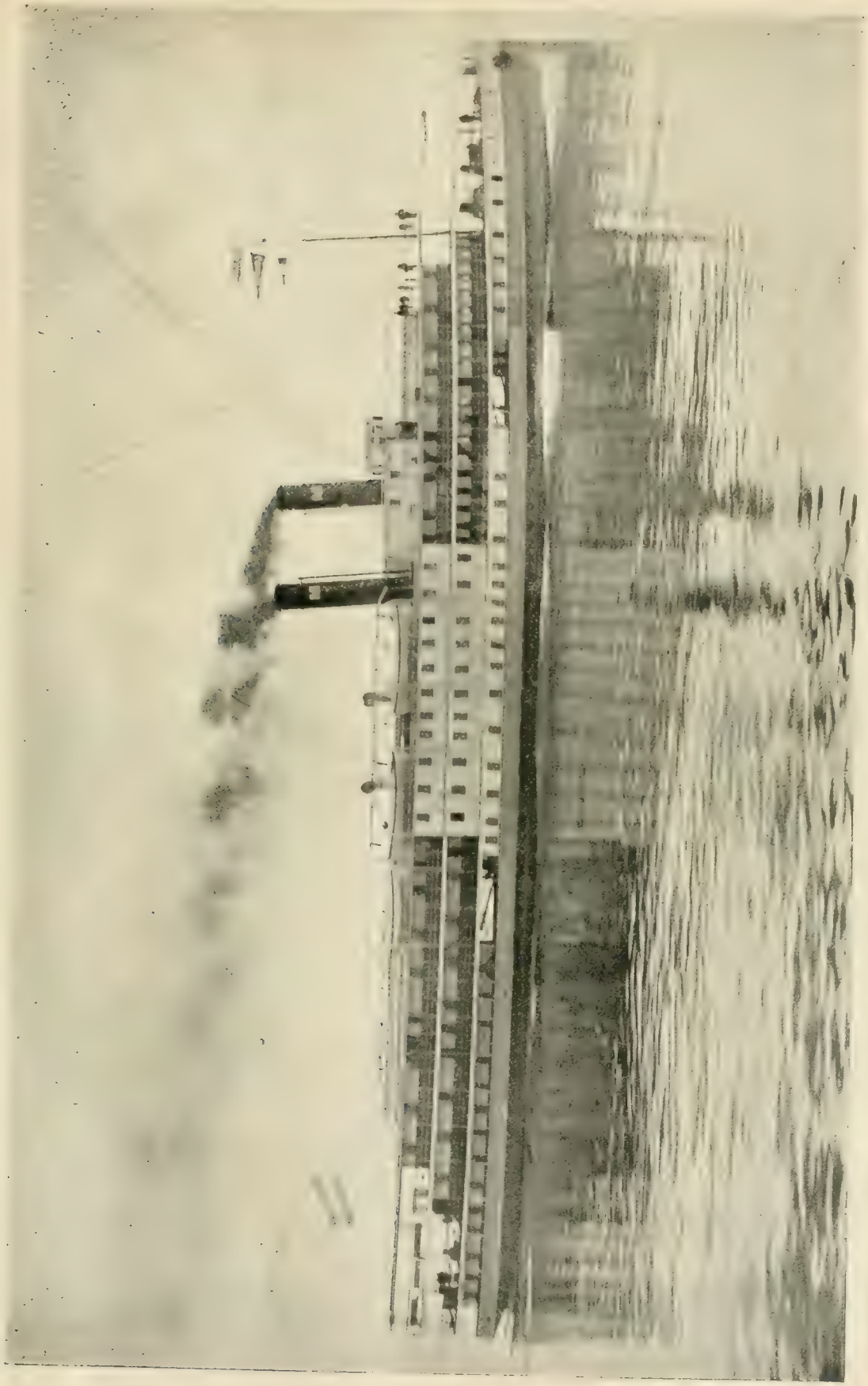
All the air, circulating, feed and bilge pumps are worked by independent engines of the latest types. The boilers are four in number, are made for a working pressure of 180 lbs. per square inch, and are fitted with forced draft supplied by two large fans.

A speed of nearly eighteen knots per hour has been attained with a draught of only seven feet. The vessel's dimensions are: Length overall, 300 ft.; breadth on water line, 45 ft.; extreme breadth over sponsons, 62½ ft.; depth moulded to main deck, 12 ft.; gross tonnage, 2,670 tons. The total height from keel to top of wheelhouse is 48 ft.

The hull is constructed throughout of Siemens-Martin mild steel; and, although of comparatively light scantling, the hull is carefully braced and pillared to avoid vibration. No fewer than seven water-tight bulkheads are supplied. The main deck is of steel, as are also the deckhouses.

Another feature of this ship worth noting is the driving all the deck machinery by hydraulic power, thus ensuring both rapid and noiseless working. The pumps and accumulators for this gear are fitted in the engine-room. For handling cargo the appliances consist of four hydraulic cranes on the main deck working the four side hatches. The vessel is steered by a pair of powerful hydraulic rams, placed aft over the rudder head, and controlled from the wheelhouse. There is also a hand-steering gear provided. A complete installation of electric light is fitted throughout the ship, including cargo and signal lights. The power is supplied from a pair of dynamos in the engine-room, with cables led from the switchboard to distributing boxes in convenient positions, from which circuits are taken to the saloons.

The *Londres* is a departure from the accepted type of American steamers, for while in general appearance she somewhat resembles the Fall River line of New



THE "LONDRES."

Built by Messrs. Gourlay Bros. & Co., Ltd., of Dundee, for the River Plate Passenger Service.

York steamers, having four decks and long ranges of deck houses with sides extended on brackets beyond the line of the ship's side—"sponsoned out,"—yet all the American boats are of the paddle type. High speed combined with light draught have been held to necessitate paddles, although these steamers are inconvenient in getting alongside, and when laden with cargo diminish in speed. The adoption of the three-propeller type—one propeller in the centre and one on either side—gives not only a high rate of speed without vibration, but enables the vessels to be much easier handled.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

The British Shipowners' Company.

NEARLY thirty years ago a successful Liverpool undertaking, the British Shipowners' Company, felt that the time had come when it should supplement its fine fleet of sailing vessels by a few cargo steamers. It accordingly ordered several vessels, of comparatively large tonnage, for those days, from Messrs. Harland & Wolff. These ships were slightly smaller editions of the cargo vessels which at that time the White Star Line was adding to its fleet. If I remember rightly, when the Guion and Inman Lines were in want of vessels to take the sailings which their own steamers were unable to deal with, they used to turn to the British Shipowners' Company. Larger and finer ships were added to the list as time went on, the policy of the directors being ever to dispose of the older ships before they became too obsolete to readily find customers. One or two of the ships, for example, found their way into the fleet of the Holland American Line an undertaking which nowadays gets new tonnage of the highest class whenever it needs additions. In the time of the South African War the vessels of the British Shipowners' Company were found extremely useful as Government transports. But since that date the ships have been gradually sold. Three of the best and largest—vessels not far short of 8,000 tons gross register—have gone to an Italian passenger line, and the last of the steam fleet was reported sold to Russian buyers in October, 1906. This was the *British Trader*, a steamer of about 3,500 tons, built some ten years ago at Newcastle. A few days later followed a notice convening a general meeting of the company, and it has now been resolved to wind up the business in voluntary liquidation.

The Salvage in the St. Lawrence.

Given a free hand and it would appear that the skill and patience of the modern salvor can overcome difficulties which, at first sight, would appear practically insuperable. It is just over a year ago that the fine Allan liner *Bavarian*, which made for herself so great a name in the transport service during the South African War, stranded on Wye Rock, Grosse Island, in the River St. Lawrence. The casualty occurred in thick fog, and an inquiry, which was held in due course, fixed the blame on the pilot. Prompt attempts were made to get the vessel, which was valued at £130,000 for insurance purposes, afloat before the close of the season. But these were unsuccessful, and, after a final trial on November 25th, 1905, she was left for the winter. It was then thought by many that the vessel was a total loss. As such she was abandoned to the underwriters by her owners. When the new season opened, however, further examination of her condition was made. Reports were by no means hopeful. She lay for a great part of her length on boulders, and her hull was badly damaged, especially under the machinery. Nevertheless, it was determined to see what could be done, and arrangements were made, I believe, on the basis of 50 per cent., "no cure, no pay," with certain American and Canadian salvors of experience. To the satisfaction of those in charge of the operations she was got afloat on November 16th, 1906, after a sojourn on the rocks of about a fortnight over the year, and safely taken to Quebec. It now becomes a question as to whether or no she will have to spend another winter in the River St. Lawrence. The owners' interest in the ship is on that of being part underwriters in her, they having left, as is their invariable practice, a substantial part of her value uncovered by insurance. The vessel, therefore, when repaired, is not likely to again find her place in the fleet of her old company. Indeed, a new ship to be named the *Corsican*—has been ordered to replace her, and this vessel is not far from being ready to take the water in the Clyde. But the confidence and perseverance of the underwriters, in having undertaken and continued the operations, and the skill of the salvage experts, can hardly be spoken of too highly. Resort to air-compressing machinery has been largely made, and at the last moment additional air bags were sent to Wye Island from New York, to render success certain by the provision of extra buoyancy. Whatever may be the eventual fate of the ship, the feat of floating her is one which will be a landmark in the history of salving operations.

Attempts at Salvage

of ancient treasures seem to be, at the moment, well to the fore. The latest scheme is one for the recovery of the half million of Australian gold which went down, seven and forty years ago, in the tragic wreck of the fine auxiliary clipper *Royal Charter*, when she was almost within sight of her destination. There was great loss of life, as the ship went rapidly to pieces. If my memory serves me right, when I used, as a boy, to spend my holidays at Llandudno, like most Liverpool children of those days, I heard many tales of sovereigns which had been washed ashore and found on the sands near which the vessel went to pieces. This, if true, would tend to show that some, at least, of the cases in which the treasure was packed, gave way long ago, and thus it is more than likely that it will not be found in large parcels, even if the salvors are fortunate enough to meet with any considerable reward for their labours. They would seem to have anticipated this, for, as I understand it, their intention is to proceed by dredging the sands in the neighbourhood of the disaster.

At the close of the year 1861 a famous clipper ship, the *Empress of the Seas*, was burnt off Port Philip Heads. It has recently been noticed that vessels which dropped their anchors in a certain spot in the bay were unable to recover them. At last divers have been sent down, and found that the spot which proves so attractive to ground tackle is the wreck of a burnt wooden vessel, filled with seaweeds. It is believed that the remains are those of the old *Empress of the Seas*, and that there will be a chance of salvage of treasure. But I find from my own note of the wreck that, though the vessel certainly carried some treasure, the news that came to England was to the effect that it was all saved before the vessel sank. Still, in those days, facilities of communication were so bad that the facts may prove to be otherwise than was then stated.

The Belgian State Railways

have found the turbine steamer *Princesse Elisabeth* a great success in many ways. She is said to be the fastest vessel in the short sea trade, and she has made her mark on the numbers of passengers travelling between Dover and Ostend. For some time there have been announcements that further vessels of her type are to be added to the fleet, and now comes the authoritative statement that the necessary funds for one sister to her have been provided by the Belgian Government, and that the order is to be placed forthwith.

Some complaints have been made of late as to the cost to the Belgian authorities of their fine sea service. It should not be forgotten that the line is a valuable feeder to their railway system, for without it they would have a poor share enough in the international traffic. But it would seem to me that there is room for considerable saving as things now stand, for it is surely unnecessary to keep nine or ten vessels for the maintenance of the service, even if there are three sailings in each direction every day. The disposal of some of the older vessels would not in any way weaken the fleet, and it would certainly largely diminish the charges for upkeep.

A Windfall for a Steamship's Crew.

It is well known that the Crown can decline to be sued in the courts, and that the Royal Prerogative covers His Majesty's Ministers in their official capacities. Thus where Admiralty property is salved there can be no salvage suit brought against the Crown. But the practice of recent years has been that the representatives of the department have stood by, in cases where ships carrying Government stores have been rescued, and have intimated that, whilst the actual

suit can only touch the ship and her freight, my Lords wish it to be understood that, as a matter of grace, a payment proportionate to that awarded in respect of ship and freight will be paid by them in respect of their property. On March 25th of the present year, the Holt liner *Laertes*, homeward bound from Java, sighted the large steel barque *Simla* in a very tight place off the north-western point of Thwartway Island. She was driving on to a lee shore under the influence of a strong current. The holding ground was very bad, and the ship was surrounded with shoals, one of which she had nearly reached. Her crew were exhausted, and, but for the coming up of the *Laertes*, she and her cargo would, in the opinion of the President of the Admiralty Court and the Trinity Masters who advised him, have become a total loss with possible loss of life. The *Laertes* towed the ship into safety, though at considerable risk to herself, having to swing on her anchors in this bad-holding ground, subject to the action of a six or seven knot current, whilst she got herself in position to get hold of the *Simla*. The value of the ship and freight which was saved by the exertions of the *Laertes* amounted to some £12,850, and on that value the Court awarded the salvors £1,500. Of this sum £1,100 went to the owners, £125 to the master, and £275 to the crew. It may be thought that the proportions awarded are unusual; but it must be remembered that the *Laertes* herself was put in considerable danger, and that the value of what the owners had at risk was not far short of £160,000. They are therefore entitled to a larger share than is usual. Similarly, the master, who showed great skill and judgment, and undertook serious responsibility, earned a good reward. But no one ought to grumble if the Admiralty does the right thing, for the value of the Government property at risk in the *Simla* was but little short of £190,000! That is to say about fifteen times the value of the ship and her cargo! Thus the figures awarded by the Court are only about one-fifteenth of the further sums which those who will benefit by the award will eventually receive. The total sum payable will amount to something not far short of £23,000. This must be almost a record salvage. The great value of the *Simla's* cargo is reached from the fact that it was largely munitions of war, including such costly and dangerous goods as ammunition for the 12-in. guns of H.M. ships.

The Collision

between the steamship *Kaiser Wilhelm der Grosse*, of the Norddeutscher Lloyd, outward bound from Bremen, Southampton, and Cherbourg to New York, and the West India Royal Mail liner *Orinoco*, from Southampton to Cherbourg, seems to have been sufficiently alarming, and one can hardly be surprised that the steerage passengers of the German vessel—coming, as the large proportion of them did, from inland towns in Hungary and Prussia—were thrown into a state of panic by the shock, which took place so soon after the commencement of their voyage, and happened amid the alarming conditions of darkness and fog. The loss of life is lamentable, but it might easily have been infinitely worse, whilst the damage to the vessels seems to have been happily comparatively insignificant. It is true that £40,000 is a large sum of money, and that that is the estimate of making good the defects of the *Kaiser*. But in dealing with these great ships the thousands soon mount up, and the cost of missing or postponing a voyage and sending the passengers forward by other conveyance is in itself a serious matter.

The End of an Old Liner.

Speaking of the Norddeutscher Lloyd line, it may be noted that the *Lahn*, last of their Fairfield-built express liners, has reached the final stage of her career. She was small by modern standards, being of but 5,383 tons gross register. But she was a great favorite when she came out nineteen years ago in the Atlantic trade. After she ceased to be employed in her owners' New York service she was transferred to the Russian flag, and took part in the famous progress of the Baltic Armada to the Far East. She is now reported as having proceeded to a German shipbuilder's yards for the purpose of being scrapped. She was, I believe, the first vessel to be fitted with triple-expansion engines of the five cylinder type.

Another Shipping Combine.

One would have imagined that the ill luck which has befallen Mr. Morgan's attempt to corner the shipping trade of the North Atlantic would have deterred others from following in his footsteps. Yet another American financier is attempting to get a monopoly of the lucrative coasting trade of the United States. He is said to have put some eight and a-half millions sterling into his purchases of various well-known lines, such as the Clyde Steamship Company, the Metropolitan Steamship Company, the Eastern Steamboat Company. Into the last-named concern he had already consolidated four or five lines. The latest acquisition is the Mallory Line, and now he is reaching out to capture some of the companies trading to the West India Islands.

The probability of the success of his venture depends, of course, to some extent, on the price that he is paying for his purchases. If he is giving prices comparable with those which Mr. Morgan gave for some of his "window goods," nothing but disaster can result; but if the cost of the lines acquired is in any way comparable with their values, money be made out of the business—at least, for a time—since it must not be forgotten that there is no international competition in the American coasting trade. British and German steamships are altogether excluded from operating in it, as it is preserved by Act of Congress to ships sailing under the United States flag. Further, foreign-built ships can be allowed United States Registry by special Act of Congress only. This being so, it is unlikely that, for a time, at least, competition can be created against the new monopolist, and he will have the sea transit to himself, limited only between certain points by the rivalry of railroads and inland canals. The result may be one more demonstration of fiscal practice to the United States voter, though it is not inconceivable that it may be the financier who learns the lesson; for shipowning is a business to which one must be brought up, and skilled financiers who meddle with it sometimes burn their fingers, and that severely enough.

The Institution of Electrical Engineers.—At the ordinary general meeting, December 6th, "Selection and Testing of Materials for Construction of Electrical Machinery." By Professor J. Erstein, Foreign Member. (Adjoined Discussion.)

The Combination Metallic Packing Co. Ltd.—We have received catalogues of the various supplies manufactured by the Combination Metallic Packing Co. Ltd., of Gateshead-on-Tyne, and we have pleasure in mentioning that the manufactures of the firm have recently been awarded the Gold Medal at the International Exhibition of Milan, 1906. They have recently introduced a metal-jointing ring consisting of an annular or disc body, having a series of ridges with sharp edges mounted thereon. These rings will not corrode, and do not set up galvanic action with the parts on which they abut as a joint. We understand that, although only recently placed on the market, such unusually good results have been obtained as to bring about a great demand for this class of article.

Grisol.—We have had brought to our notice a protective paint which goes by the name of "Grisol." It is intended as a substitute for red lead, and, containing no deleterious or poisonous substances, is claimed to be perfectly innocuous. It can be used with equal satisfaction upon wood, stone, plaster, &c., forming, as it does, a hard, damp-resisting surface, while on metals it acts as a protection from rust and corrosion. The paint is unaffected by extremes of temperature, and is said to resist the action of sea water and ammonia. Another property it possesses is its resistance to heat, preventing blistering or cracking, when applied to steam pipes, smoke-boxes, boilers, and heating apparatus generally. It is said to withstand a temperature of 300 deg. F., and higher. The colour of the paint is in its favour for finishing, that of a blue grey, and it dries quickly. While suitable for painting structures of various kinds special mention is made of its use for engines, pumps, tanks, and ships, as a preventive from corrosion, damp, or the action of acids. A point in favour of this paint also is that it is half the weight of red lead in paste of the same consistency, and covers double the surface; while either in paste as delivered, or thinned ready for use, Grisol will keep any length of time, avoiding the inconvenience of red lead, which becomes solid when ground in linseed oil.

Another form of the same preparation is Grisol Cement, which has proved excellent for water, gas, and steam joints. Made with this material the joints are said to be capable of withstanding high pressure, and to be perfectly tight under all conditions. The cement is supplied in thick paste of the necessary consistency for the purpose. For further information we refer to the makers, Messrs. Lefranc & Co., 27, Fetter-lane, E.C.

MAY'S LIQUID REGISTERING APPARATUS.

IN 1903 we placed before our readers a description and illustrations of May's Liquid Registering Apparatus, the object of which is to enable the officer in charge to know at any time the condition of his ship with regard to ballast tanks or similar apparatus without depending upon anyone else, and instead of sounding the wells with rod and line as is now the practice.

It will be recognised that the use of such apparatus must minimise cargo damage.

We have now pleasure in presenting to our readers illustrations showing the latest type of the apparatus.

Figure 1 represents the transmitter and receiver for different depths, and Figure 2 is a view of a receiver and detail view of the transmitter.

A transmitter is fixed in each tank, or compartment, and consists of a number of insulated rods of various lengths, or a pair of rods at a predetermined height. These rods can be so fitted that a rise of half an inch or more of water can be readily ascertained, or, when it is necessary to know only one depth, in such a manner that the alarm is transmitted as soon as the danger point is reached.

The transmitting apparatus is placed within a

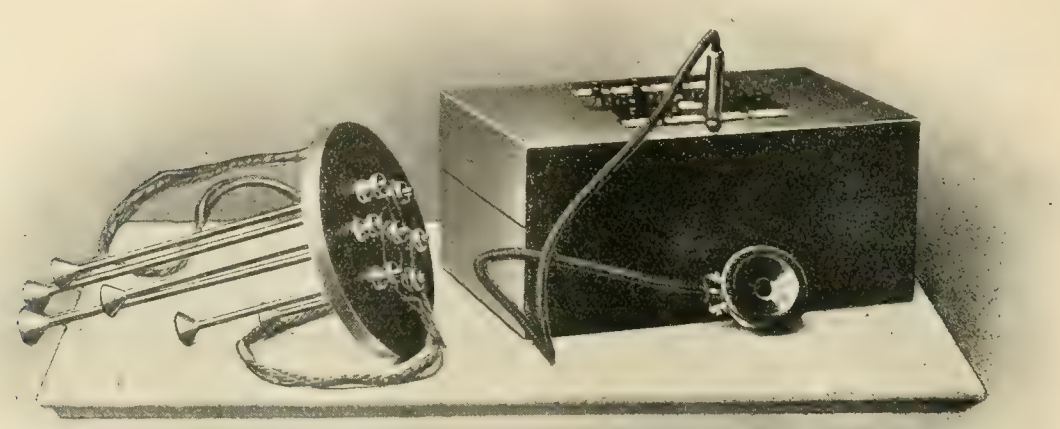


Fig. 1.

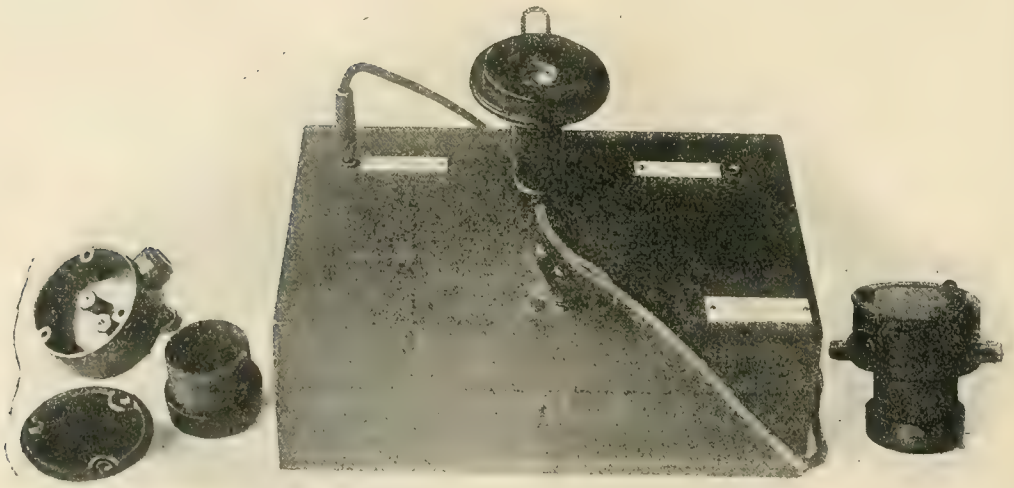


Fig. 2.

galvanized iron box in order to protect it from injury.

Conducting wires are laid through these rods to a switch board, placed for preference in the Chart House, or on land, in the office of the Engineer-in-charge. A receiver board is provided with a number of test jacks, the number dependent upon the tanks to be protected. There is also connected to the receiving board an induction coil, battery, mercurial-level, switch, and a loud-speaking telephone receiver. The latter is attached to a telephone plug.

Supposing now we require to know the depth of water in the bilge, or a compartment which we will call "A." The Officer turns the switch to "ON," and immediately the buzzing of the induction coil is heard. He then places the receiver to his ear, and, taking the plug, inserts it into the "A" tank jack. No mistake can be made in this, as each jack is labelled with the name of the compartment to which it belongs. If water is bridging the rods of the compartment plugged, a loud buzzing will now be heard in the receiver, but if there is no water the receiver will give no sound. A test can be made at any time and in any weather. At sea it is essential to know the mean depth of water in the tanks, though this, at present, is practically an impossibility since, when the sounding rod is put down while the ship is rolling, the surge of the water in the tanks wets the rod higher than the true depth. With the Water Level Register, however, the mean depth only is given. This is accomplished by means of a mercurial-level, circuit closer, which only makes contact when the ship is on practically an even keel. The whole operation of testing the condition of an ordinary-sized vessel only takes about five minutes.

This apparatus is being handled by May's Patents, Balfour House, Finsbury Pavement, London, E.C.

THE NEW CIRCULAR CUT FILE.

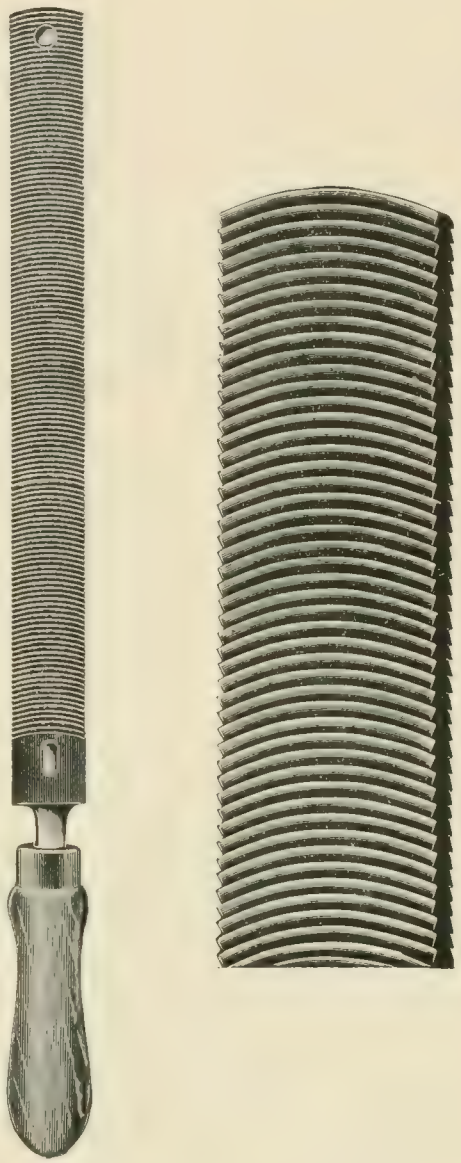
It will be somewhat difficult to imagine that after files have been in use for so many years any very radical improvement was possible, but the Patent File & Tool Company Limited of 8, White-street, Moorfields, London, E.C., have clearly shown by the new file they have put on the market that there was scope for great improvement in this class of tool.

The new file which we illustrate in the adjoining diagram has circular teeth cut specially deep which ensures the cut of the file without fear of slipping, and owing to the form of the teeth the file cannot chase or run to the side. Owing to the shape of the tooth the file readily clears itself and is probably the only tool which can be used to advantage on soft metals such as aluminium &c. It is equally efficient on hard steel, wrought or cast iron, brass and copper and can be used also as a farrier's wood rasp.

It is claimed that this file will do the work of three ordinary files, at the same time cutting at least three times as fast and keeping its edge considerably longer. It can be recut at a very small cost, four times, and when so recut is as good as a new file.

The file cuts are formed upon a plain bar of steel which latter is supported upon a special back or holder by means of a wedge bolt fastening. One of these special backs or holders is supplied with each dozen files.

It is claimed that the holder enables a mechanic to get a much better purchase over the tool and in this way is able to utilise to the fullest capacity its superior cutting qualities.



Taking the cost of this new patent file with four recuttings in comparison with ordinary files of the best quality, there appears to be a distinct gain of 36 per cent., and this is without taking into consideration the greatly superior cutting qualities of the new file or the longer time this file will retain its cutting edge as compared with ordinary files.

W. F. Stanley & Co. Ltd.—We have received a small brochure on a new method of drawing with modern appliances, written by Mr. W. F. Stanley, of the well-known firm of Messrs. Stanley & Co. Ltd., of 4 and 5, Great Turnstile, Holborn, London. This publication not only details in a very interesting manner the new method of drawing but also illustrates all the most up-to-date appliances for use in the art of mechanical drawing, and one cannot but be struck by the great advance made within the last twenty-five years in this class of apparatus.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

REAR-ADMIRAL C. G. ROBINSON succeeded Rear-Admiral Sir Henry Barry, as Admiral Superintendent, on November 10th. Before he left, Sir Henry issued a general order, thanking both the superintendent and the subordinate officials, and also the employees, for the assistance they had given him during his tenure of office. Admiral Barry was not long idle, for the same day he hoisted his flag at this port in the *Bacchante*, as Admiral Commanding the Third Cruiser Squadron; and, a few days later, the vessel left for Gibraltar, to relieve the *Leviathan*. A large number of men have been employed putting the finishing touches to the *Dreadnought*. All sorts of rumours have been afloat concerning this vessel. First, the King was to take a trip in her, and then the Prince of Wales was to hoist his flag as Admiral, and go for a short voyage; but both rumours are improbable. It was at first thought that she would be the flagship of the Channel Fleet; but it has been decided that she is to act in that capacity in the new Home Fleet. We are so used to Royal visits that they attract but little attention; but the visit of King Haakon and his Queen was an exception, for is not the King an Admiral of the British Fleet, and his Queen one of our own Princesses? They received a royal welcome, and the ships of the Reserve Division assembled at Spithead to salute them. The seagoing destroyer flotilla has gone to Portland, all the repairs having been completed. Many of the vessels required considerable attention, it being found that some of the deck plates and side plates had worn so thin that they required renewing. In future, these craft are to be subjected to periodical surveying, so as to ensure that they are thoroughly seaworthy. Although oil fuel has now become a recognised thing, experiments are still being carried out with the destroyer *Surly*, which has been used for that purpose for the past six or seven years. The *Spiteful*, too, has been carrying out similar trials. Her boilers are to be retubed; and it speaks well for oil fuel that her tubes are in such good condition that they could have safely been used for some time longer. Preparations are in steady progress for commencing our new battleship, which is, I understand, to be laid down on New Year's Day. The shipbuilding shop has been fitted with some of the most up-to-date appliances procurable, and workmen are busily engaged in preparing the material, which has been already delivered. The smithery has been re-opened; and on all sides there are evidences that the building slip will before long again present a busy scene.

"Mother" Ships and Repair Ships.

In consequence of the growth of the torpedo craft flotillas it has been found necessary to provide vessels which are now generally known as "mother ships." The policy of the Admiralty seems to have set strongly in the direction of providing these vessels, so as to have an ample supply to meet the needs of the grouping of the torpedo flotillas. The torpedo vessel *Hecla*, which was brought home from China on the reduction of the squadron in those waters, is now the depot ship of the Portsmouth Reserve Flotilla; the cruisers *Leander* and *Blenheim* carry out similar duties at Chatham, and the *Blake* at Devonport. In addition, there is the ex-storeship *Tyne* which is attached to the Channel Fleet as a depot ship for destroyers; the old cruiser *Imperieuse* (now *Sapphire II.*), the depot ship for destroyers at Portland; and the torpedo vessel *Vulcan* at Malta, the depot ship for the destroyers in the Mediterranean. Although there at present no repair ships described as such actually in commission, the practice of placing such vessels with each of our large fleets has by no means been abandoned, as the mother ships are generally made to the duty of carrying out repairs as well as caring for their brood of torpedo craft. The repair ship *Assistance* is now ready for duty again with the Atlantic Fleet at Gibraltar, after repairs necessitated by grounding. A new ship, the *Cyclops*, of 11,000 tons, is completing at the works of Sir James Laing & Sons, Sunderland, and the distilling vessel *Aquarius* is about to be converted into a repair ship at Pembroke Dockyard. The *Cyclops* will carry a crew of nearly three hundred artificers, and she will be, to all intents and purposes, a floating factory. It is said that there is not a machine to be found in a shipyard or marine engineering works that is not represented on board the vessel. Thus, before long, we shall have nine vessels, all equipped with machines and mechanical apparatus which will render them able to execute repairs to small craft and also to other ships without the necessity of falling back on the dockyards. Needless to say that in war time this will be of very great value.

Chatham Dockyard.

We have had a visit from Admiral Sir Gerard Noel, who is to succeed Sir Hugo Pearson, as Commander-in-Chief at the Nore. When he hoists his flag, which he will do early in the New Year, Admiral Noel will occupy the new and commodious official residence at Chatham, which has been erected at a cost of about £30,000. The change of headquarters from Sheerness to Chatham is in consequence of the formation of the new Home Fleet. The battleships and cruisers of the Reserve Division have arrived from Sheerness, and been berthed for the winter. Advantage will be taken of their presence here to refit several of them. Two or three vessels of the Channel Fleet are also due about the middle of December for their annual refits. The battleship *Dominion*, of the Atlantic Fleet, is to have her repairs carried out here, instead of at Gibraltar, as was at first contemplated. It will be remembered that she sustained some damage by grounding in the St. Lawrence during her recent visit to Canada. She is now at Bermuda, and will proceed home when she has been patched up. The *Leviathan*, the old flagship of the Third Cruiser Squadron in the Mediterranean, is to join the Medway Reserve Division, and will come here to be refitted. She will later on join the Cruiser Squadron of the new Home Fleet as flagship. Altogether the prospects of work for the next few months are quite bright. The battleship *Africa* has been commissioned, and has left to join the Atlantic Fleet. There is every reason to believe that, in point of efficiency, she will compare favourably with the other vessels of the "King Edward" class. She is the largest, most costly, and most heavily armed vessel ever built at Chatham. Work on the armoured cruiser *Shannon* is proceeding apace. She will probably go down to history as the last big ship built at Chatham. Mr. Robertson said, in the House of Commons the other day, that battleships are likely to be of such dimensions that they cannot be completed at Chatham; but at the same time every consideration is being given to the supply of suitable work for the yard. We were beginning to fear that the Admiralty might reverse their decision to build submarines here; but I hear that a start will be made with two such vessels at an early date. The machinery will also be built at this yard.

Sheerness Dockyard.

At the beginning of the New Year, Sheerness will lose something of its importance, for it will then cease to be the headquarters of the Commander-in-Chief at the Nore. It will not, however, be long before it comes to the front again, for Sheerness is to be the base of the new Home Fleet, which will, I hear, be the strongest fleet in the whole British Navy, with the *Dreadnought* as flagship. There is plenty of mooring accommodation here for the new fleet, and in a short time three sets of existing moorings will be strengthened so as to be able to berth the largest ships. The battleship *Ramillies*, one of the "Royal Sovereigns," has taken a step nearer the scrap-heap. Since her nucleus crew went to the *Africa*, she has only been manned by a skeleton crew. It is understood that three other vessels of the same class—the *Repulse*, *Resolution*, and *Royal Oak*—will soon be similarly treated. It is not long since the *Ramillies* had her port propeller and shafting repaired at Chatham. The *Magnificent*, another of the "Royal Sovereign" class, which has been relieved in the Atlantic Fleet by the *Africa*, has arrived here, and joined the Reserve Division. The destroyers of the Second Flotilla have now completed their refits. Two of the reserve destroyers, the *Orwell* and *Lively*, are having their boilers retubed, for which purpose a quantity of tubes were sent from Gibraltar. Progress is being made with the erection of the building for the generating station, and two of the boilers have arrived. The work of laying the cables is also well under way.

The Funnels of Warships.

Your Devonport correspondent recently reported that the funnels of the cruiser *Argyll* had been replaced, and he also stated that the question of increasing the thickness of the funnels of warships was receiving the attention of the Admiralty. The *Argyll*, as well as three other County cruisers, have had their water-tube boilers fitted with baffle plates, it having been found that the heat was in great measure dissipated through the funnels; indeed, in some cases, the flames reached above the top of the funnels. The plates will serve a double purpose—lengthen the life of the funnels, and ensure a more equal distribution of heat over the surface of the tube area. The plates, which are perpendicular, and transverse, are of cast steel, and fitted round the rows of water-tubes.

The funnel question is referred to in an article on "The Battle of the Sea of Japan," which Captain A. T. Mahan, of the United States Navy, contributes to the "Proceedings of the United States Naval Institute." The writer, after alluding to the damage to funnels destroying or diminishing draught, and, with it, speed, says: "If the battleships keep together, which, as a rule, they should, the fleet speed is reduced at once to that of the injured ship. This factor does not come into play in the movements which precede the action, but it may seriously affect conditions of flight and pursuit, as also the power conferred by superior engine development in subsequent operations by fleets distant from their means of repair. The loss of a modern funnel will be like the loss of a former day lower mast. Certainly no discussion of the utility of speed obtained at the sacrifice of gun power can be adequate if it does not take full account of this specific result, which has also a further bearing. The funnels are open to serious injury by guns of the secondary battery, 6-in. to 8-in., which there is now a tendency to discard. Whatever the improvements in quickness of handling 12-in. guns, it can scarcely be that, with an aggregate weight of broadside, they can rival in volume of fire the much greater number and more rapidly discharged pieces of smaller calibre; and, when within the limits of useful perforation, volume of fire, multiplicity of projectiles, is better than individual weight of projectile, because it gives a greater number of hits. But under any useful construction of battleships there cannot fail to be important parts vulnerable to the smaller calibres." This question of the vulnerability of funnels to gun fire reminds us of the funnels of the *Dreadnought*. In that vessel the funnels are of a compressed oval shape, and present a fair-sized target when the ship is broadside on. As one feature of the *Dreadnought* is her broadside fire, it is open to question whether it would not be better to alter the position of the funnels in the new *Dreadnoughts* to athwartship, so that only the narrow ends were presented to the enemy's fire.

Pembroke Dockyard.

Commander J. D. Edwards, the gunnery officer at the Admiralty, inspected the gunnery fittings of the armoured cruiser *Warrior* on November 9th, and a week later the vessel underwent her basin trials. She is expected to leave for Portsmouth on December 11th, or, if unable to do so on that date, on the 28th, and she will be away for forty-two days. Two gangs of shipwrights were transferred from the *Warrior* to the *Defence* on November 10th, one gang for general ship work, and the other for repairing the bilge-ways and preparing for the launch. Experiments have been carried out with the launching mixture—tallow and margarine—and this suggests that the launch will take place earlier than March, which was the date expected. The distilling ship *Aquarius* is still waiting to be taken in hand for conversion into a fleet repair ship. Her boiler accommodation is to be improved, but it is not quite certain whether she will be reboilered or her present boilers refurnaced. It is expected that the order for our new vessel will be received next April; but she will be commenced before then. The floor of the mould loft has been painted over, and the old lines filled in. The design will probably be completed in time for the laying off the ship to be begun early next year, which will permit of building operations being commenced in June or July.

Devonport Dockyard.

Materials are daily arriving for our new battleship, which is expected to be laid down on New Year's Day, by which time a large quantity will have accumulated. Painters are busy on the scrive-board, the keel-blocks have been fixed, and the lengthening of the launching ways have been taken in hand. Altogether, everything is well advanced, and speculation is rife as to the name the vessel is to bear. This, according to those who ought to know, will either be *Fearnought* or *Bellerophon*. There was once a ship of the latter name, but I do not remember a *Fearnought*. The new extension works at Keyham will be handed over to the Admiralty at the end of December; but a good deal of work is still to be done. None of the roads are completed, and practically a new dock is to be built at the south end of the north basin. It will be quite eighteen months before everything is completed as it should be. The cruiser *Doris* and the destroyer *Vixen* proceeded to Lundy Island on November 13th, their object being to recover some of the fittings connected with the torpedo tubes of the *Montagu*. It was at first announced that this ill-fated vessel was to serve as a target, the idea being to bring big guns to bear on her at various angles, but the idea has, I understand, been abandoned. The old *Indus* has been placed in dock for a clean up. It is remarkable what a large amount of deleterious matter has accumulated on her. Over twenty tons of marine growth were scraped from her bottom, but then it has to be remembered that she is a stationary ship, and this was her first appearance in dock for four years.

ENGINEERING AND MACHINERY EXHIBITION AT OLYMPIA, 1906.

Exhibit of Cochran & Co., Annan, Ltd.

THE firm of Cochran & Co., Annan, Ltd., was represented by a stand of studied simplicity, but, at the same time, of considerable interest as displaying, in diagram and photograph, the capabilities in performance, and modifications in form, of their well known vertical multitubular boiler. The marine engineer (or superintendent) was, however, most attracted by the types

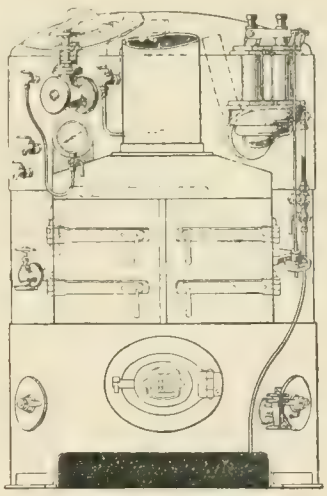


FIG. 1.

of boiler peculiarly adapted for use on board ship. The compact *multum in parvo* type without projecting smoke box demands attention, but the "C" class boiler should not be lightly passed over. These boilers take up little headroom, with mountings snugly arranged below level of crown, and as they combine all the advantages of easy access, good steam space, effective furnace and economy, with very modest dimensions, they should commend themselves strongly to the yacht, tug, and launch designer whose space is often limited,

but from whom demands of large engine power are frequently made.

This "C" class boiler is illustrated in outside and sectional elevation in the adjoining illustrations and has been especially designed for small steamers, as yachts, tugs, and launches, for which purposes a large number have been supplied. In addition to the small amount of floor space and head room usually allotted for the boiler in this class of boat, weight is limited, and the centre of gravity is required to be kept as low as possible. All these points have been studied and the results embodied in the modification of the standard Cochran boilers, known as class "C." But these class "C" launch boilers have, of course, also the same advantages of their taller relatives the "B" class, or standard marine type. These include, the absence of screwed stays to give trouble by their leakage or interfere with circulation, examination and cleaning, and all the larger sizes are also fitted with the recently patented

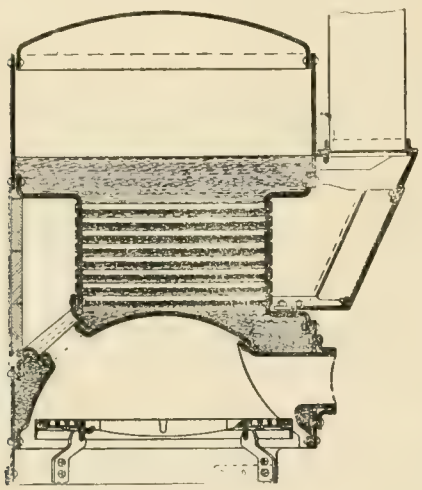


Fig. 2.

Cochran Seamless Furnace which is pressed from one plate, without weld or seam, and thus presents nothing but a smooth surface to the flames. The small horizontal boiler of equal surface to the Cochran "C" type generally possesses too small a grate to permit its heating surface to be effective. In the "C" class the grate is large, the furnace roomy, and it is provided with an efficient combustion chamber. The steam room is ample, but to ensure dry steam in a sea-way, internal pipes of special construction are fitted.

As regards the mountings, these are arranged so as not to project above the top of the boiler and comprise a customary set of marine mountings equal to Lloyd's requirements, with additions, such as easing gear and pressure gauge bracket, to make the whole self-contained. They are somewhat modified according to the size of the boiler. Generally speaking, in the smaller sizes, the manhole is fitted in the crown and there is a single spring safty valve. In the larger sizes, the manhole is inside of shell at top, and a double spring safety valve is fitted. Boilers of the "C" class are manufactured in a range of seventeen sizes.

Cammell, Laird & Co., Ltd., have opened a branch office at Nos. 28A and 29, Collingwood Buildings, Newcastle-on-Tyne, under the control of Mr. J. Johnson, who, for many years, has represented them as district agent.

ELECTRICITY ON BOARD SHIP.

III.*

By Sydney F. Walker, R.N., M.I.E.E., Assoc.M.I.C.E., &c.

The Continuous Current Dynamo (*Continued*).

THE continuous current dynamo is usually arranged to provide its own magnetic field. As electrical engineers express it, it is self-exciting. After any mass of iron has once been magnetised, it retains a certain quantity of magnetism, which gives rise to a feeble magnetic field. When a dynamo is finished, the first thing that is done, before it is run for testing, is, a current from any convenient source of electricity, such as the dynamo that is used for lighting the works, is passed through the field coils of the machine, and the iron cores of the field magnets thoroughly magnetised. After that is done the machine is run by itself, and quickly provides its own magnetic field. The feeble magnetic field remaining after the exciting current has been cut off, generates a feeble electrical pressure in the coils of the armature, when the latter is revolved in the polar space. The small pressure created causes a small current to pass through the field magnet coils, this small current increasing the magnetism remaining from the preliminary excitation. The increased strength of the magnetic field so created, generates an increased pressure in the conductors on the armature, this causing an increased current to pass through the field magnet coils, and so on, until the machine has built up the full pressure for which it is designed, this taking usually only a few minutes at first, and only a few seconds after.

In practical work it is sometimes arranged that the current for the field magnet coils is supplied from a separate exciting dynamo, run specially for the purpose. This is a very convenient arrangement, where, as in modern generating stations of all kinds, two or more dynamos are running together, as it enables the excitation of any individual dynamo to be varied conveniently, and at will. For small stations, however, the more usual practice is for the dynamos to be self-exciting, and there are three forms of self-excited dynamos, known respectively as the series wound, the shunt wound, and the compound wound.

The Series Wound Continuous Current Dynamo.

In the series wound continuous current generator, which is not much used at the present day, only occasionally, in fact, for arc lighting, the field magnet coils are formed of thick wire with a few turns only, the wire being sufficiently large to carry the whole of the current the machine is capable of generating. The current is taken from one of the brushes, which receive it from the armature, as is explained below, through the coils of the field magnet to the outer circuit, the second cable for the outer circuit being connected to the other brush. The peculiar feature of the series wound generator is, every variation in the outer circuit is reflected, not only in the armature, but in the field coils, and therefore doubly in the armature. Thus, if the resistance in the outer circuit increases, as will be explained later, leading to a decrease of the strength of the current passing in the circuit, the field magnet coils, having a smaller current passing round them, create a magnetic field of smaller strength, this giving rise to a smaller pressure in the armature coils, this again reducing the strength of the current passing in the circuit. On the other hand, if the resistance of the outer circuit is decreased, a larger current passes through the whole circuit, the increased current strength gives rise to an increased magnetic field, and this again causes increased pressure in the armature coils. The readiest illustration of this is where a single arc lamp is fed from a single series wound generator, driven by a steam engine. When the arc burns long, the resistance of the whole circuit is increased, the current is decreased, and the pressure the machine is generating is also decreased, with the result that the lamp is very liable to go out. On the other hand, if, as very frequently happens, the arc suddenly shortens considerably, the resistance of the circuit is thereby decreased, the current passing is very much increased, and the pressure created in the armature coils is also increased, this leading to a further increase, and very often to the engine pulling up, since it is suddenly called upon to do largely increased work.

*For articles I. and II. see last two issues.

THE SHUNT WOUND GENERATOR.

In the shunt wound machine the field magnet coils are supplied with a current forming only a small fraction of that generated by the armature. The coils are wound with fine wire, and the current passes round the iron cores a very large number of times, the increased number of coils making up for the small current strength. The ends of the coils are connected to the brushes which receive the current from the armature. The working of the shunt wound machine is the reverse, in almost every respect, of that in the series wound machine. Variations in the outer circuit are reflected in the field magnets, and thence in the armature, but in the reverse manner to that described for the series wound machine. When the resistance in the outer circuit increases, the pressure at the brushes—and therefore the current passing in the coils of the field magnets increases, and the pressure generated by the armature itself increases. When the resistance of the outer circuit decreases, the pressure at the brushes and the current passing in the field magnet coils decreases, the pressure created by the armature also decreasing. In the early days of the incandescent lamp the shunt wound machine was employed for furnishing current for a number of lamps, as it was so very much more suitable for the work than the series wound machine; but the trouble arose that, if a number of the lamps were turned out, the pressure delivered to the remaining lamps was increased unless the speed of the dynamo was decreased, or other means were taken of reducing the pressure, and the lamps remaining in circuit were very seriously strained. Hence the shunt wound machine, except where it is used as a separately excited machine has given place to the compound wound machine, described below. The reason of the rise and fall of the pressure generated in the armature, with increase and decrease of resistance of the outer circuit, will perhaps be understood better from the following. A given armature, with a given number of conductors upon it, moving at a certain speed through a magnetic field of a certain strength, creates a certain pressure in its own coils. This is the total pressure created. The pressure delivered at the brushes, and to the outer circuit and to the field magnet coils, is this initial pressure less a charge upon it for the passage of the current passing through the armature coils. Whenever an electric current passes through a conductor, the resistance of the conductor makes a charge upon the initial pressure for the passage of the current, the charge being measured by the product of the current strength into the resistance, the pressure delivered at the end of the resistance being less than the initial pressure by this charge. Thus if the armature of a dynamo generates a pressure say, of 101 volts, and has a resistance of 0·1 ohm, the passage of a current of 10 amperes through its coils will reduce the pressure at the brushes from 101 volts to 100 volts. The passage of 100 amperes will reduce it to 91 volts, and so on. The current passing through the field magnet coils depends directly upon the pressure at the brushes, the pressure which remains after the charge for the passage of the current through the armature coils has been met and inversely upon the resistance of its own coils. As the resistance of its own coils may be taken as constant, the current passing in them varies directly as the pressure at the brushes, and, therefore, inversely as the current passing through the machine. It should be noted that in the extreme case where a shunt wound machine is short circuited, where an infinitely low resistance connects its terminals, such as a short piece of metal, the machine furnishes no pressure and no current. It is practically dead.

THE COMPOUND WOUND MACHINE.

The compound wound machine is a compound of the series and shunt wound machines. Its field coils consist very largely of fine wire, arranged as a shunt to the external circuit, the ends of the coils being connected to the brushes as in a shunt machine, but a certain portion of the magnetism is supplied by a few turns of thick wire, through which the whole of the current supplied by the armature passes. When no current is passing to the outer circuit, the series coils furnish no magnetism. When current is passing out to the outer circuit, the series coils furnish magnetism exactly in proportion to the current passing, and the number of turns is so arranged that the current passing in them makes up for the magnetism that would be lost by the reduction of pressure at the brushes, and it also furnishes sufficient to provide for the charge upon the initial pressure created by the armature for passing the current through the series coils themselves. A natural corollary to this is the over-compounded machine, as it is called. It will be evident that it is simply a matter of calculation to provide an increasing pressure at the ends of the series coils, instead of a constant pressure, and this arrangement is often made use of to provide a constant pressure at some point at a certain distance from the generator. Thus, in the case of a big ship, it may be convenient to provide a constant pressure, say, in the neighbourhood of the forecastle, or in the neighbourhood of the after cabins. This arrangement enables smaller distributing cables to be employed, and is often a consideration. Where space is important, as it sometimes is on board ship, it may be worth while to make this economy.

GEIPEL'S RAPIDITY TYPE PATENT STEAM TRAP.

THE Geipel Steam Trap has recently been improved in construction and the adjoining illustration clearly shows the direction in which the improvements have been made.

A special feature of this type of trap is a method by which the expansion movement of the controlling element is multiplied without the use of levers, cranks, pivots, or other devices.

The improvements embodied in this novel design consist in the rearrangement of the valve so that it can be held on its seat by the steam pressure, consequently allowing a valve of much larger area to be used than in the ordinary trap where the valve is closed against the steam pressure, the provision of means for rotating the valve so that each time a discharge takes place the valve tends to grind itself in, the means by which the action of the valve is such that when blowing through it is forced well off its seat to give the maximum opening, and the obviation of noise, straining and cutting and the rapid discharge which results from the large opening through which the water is forced under high pressure, is dealt with by the provision of an arrangement which automatically reduces the velocity of the water; this throttling action only occurring under high pressures and not under low.

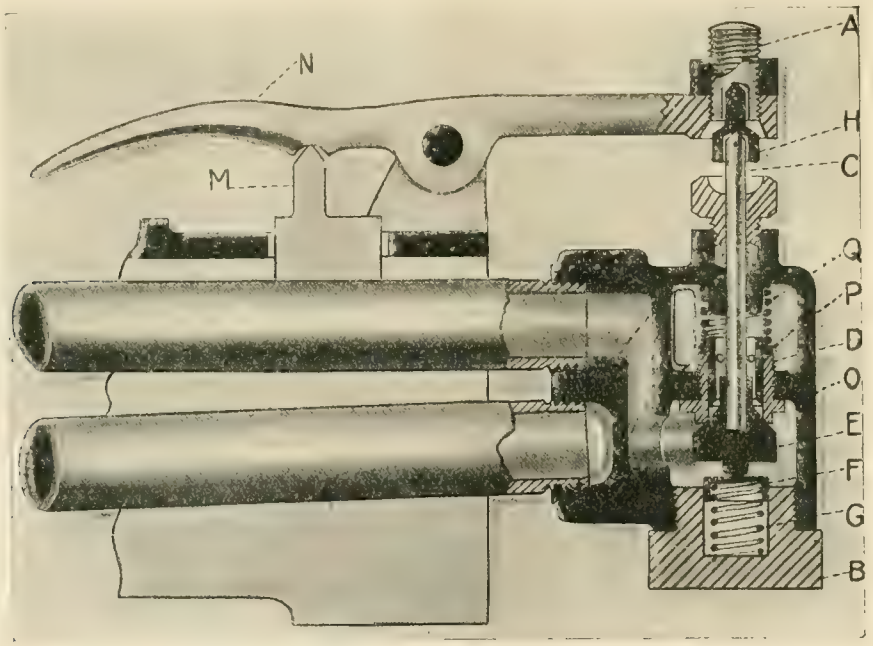
Attempts have been made in expansion traps of other types to overcome this objection by use of a permanent throttle in the valve arrangement but this, it will be recognised, has the effect of reducing the discharge capacity to low pressures.

Referring to the illustration the brass tube, which constitutes the inlet and to which the vessel to be drained is connected, is placed at the top of the trap while the iron tube constituting the outlet for the discharge is at the bottom. This, it will be recognised, is the converse of the ordinary Geipel trap and makes the most convenient disposition for inlet and outlet.

The valve E is held normally on its seat by the steam pressure combined with the pressure of the light spring G. When the trap is cold or full of water the valve is depressed from its seat by the valve spindle C, which abuts against the end of the lever N. When steam enters the brass tube the latter expands and moves the valve casing O downwards. The steam pressure and light spring then close and hold the valve tight until water has again entered the brass tube and cooled it, upon which the brass tube contracts and moves the valve casing upwards until the valve spindle C impinges on the lever and forces the valve open. As soon as the

valve is open the rush of water, so to speak, forces or wedges the valve downwards, thus making the large opening which gives the rapid discharge. So rapid indeed is the discharge that the automatic throttling device above referred to has been found desirable at high pressures in order to avoid shock, strains and noise. This device consists of a movable bush P, controlled by a spring Q; its action is automatic so that when the trap is discharging at low pressure as, for example, when steam is first turned on, the bush does not tend to throttle, but when the pressure rises and there is an increased discharge, the friction thereof moves the bush in an upward direction against the action of the spring, thus reducing the aperture of the discharge and consequently its velocity.

With this automatic device then the trap discharges rapidly whether it is working under high or low pressure.



Geipel's Rapidity Type Patent Steam Trap.

The valve E is separate from the valve spindle and is therefore not held fast by the friction of the stuffing box; further being provided with veins it is caused to rotate whilst discharging and consequently to grind itself in at each discharge so that the seat is kept in good order.

The action of the trap is such that there is no dribbling but as soon as ever the trap commences to discharge, the valve is forced well open; a sharp blow-through then occurs until all water is discharged, when the trap is as suddenly shut.

The facility for removing or renewing the valve and seat which is provided in the old type has been retained in the new type.

The ordinary rapidity type of trap above described will work with ranges of pressure, without adjustment considerably greater even than in the old type. For example, the trap adjusted to close at 60 lbs. will work up to 150 lbs., or a trap adjusted at 90 lbs. will work up to 180 lbs.

LAUNCH OF THE RUSSIAN CRUISER "RURIK."

THE first warship built for Russia since her war with Japan was launched by Vickers, Sons & Maxim, at their yard at Barrow-in-Furness on Saturday, November 17th. It is interesting to know that the old *Rurik*, which was sunk by the Japanese, was, in her day, the cause of the building of the British cruiser *Powerful*, which was also launched from the Barrow Yard. But in the ten or twelve years since then what a great change has taken place in naval construction! The old *Rurik* and the *Powerful* were protected but not armoured ships, and they were mounted by much inferior guns than those put on modern cruisers. The features of construction and design of the *Rurik* mark an advance on even modern British cruisers, and in that sense some technical account of the vessel will be interesting. Her length between perpendiculars is 490 ft.; breadth (moulded), 75 ft.; draught (mean), 26 ft.; displacement in tons, 15,000; speed on trial, 21 knots; I.H.P., 19,700; coal carried on normal draught, 1,200 tons; and numbers of officers and men, 850. The designs of the cruiser were evolved by the Imperial Technical Committee at St. Petersburg, and embrace the results of their experience, and also the lessons taught by recent naval warfare. The result will be that Russia will have in the *Rurik* not only one of the strongest and best-equipped cruisers afloat, but that she will possess a vessel which may be regarded as a type of others likely to be very useful and also likely to be required as well for warfare if necessary, as for taking part in any war in which her services may be of advantage to Russia. Her armamant is very powerful, and consists of four 10-in. breach-loading guns, 50 calibres, twin-mounted in barbettes, two forward and two aft on the centre line; eight 8-in. breach-loading guns, 50 calibres, twin-mounted in barbettes on the quarters; twenty 4·7 in. quick-firing guns, 50 calibres, sixteen in an armoured battery on the upper deck, and four in a sub-divided armoured battery on the main deck aft; twelve smaller quick-firing guns, and two 18-in. submerged torpedo tubes. The cruiser is better protected than any cruiser yet built. There is a complete water-line belt from end to end of the vessel, from a greater depth than is usual below the water-line, in order than when she is rolling in a sea she will not be likely to be hit in any

weak part. This belt is carried up to a considerable height, and tapers in thickness from 6 in. amidships to 4 in. at one end and 3 in. at the other. In the second place, there is, for the length of about 200 ft., a 3-in. armoured battery, from the top of the belt armour to the height of the boat-deck, affording armoured protection to sixteen of the 4·7-in. guns, and at the after end of the vessel there is a second battery of armour 3 in. thick, for the protection of the remaining 4·7 in. guns, this armour extending from the main belt to the upper deck. The barbettes are 7½ in. thick, and the conning-towers are 8 in. thick, and of Krupp's cemented armour. The 'midship and after batteries for the 4·7-in. guns are enclosed by armoured traversers 3 in. thick. One of the chief novelties of the ship is the provision of four range-finding towers, the thickness of the armour used here being 5 in. The combined thickness of the protective decks is 4 in., and the decks are so arranged that high explosive shells shall burst outside the vessel. To float all this armour it will be easily understood that much heavier weight has to be carried, and this has been further augmented by the introduction of electrical appliances to work the guns. This weight is again still further augmented by the increased amount of ammunition to be carried, and by a fuller installation than usual of boiler power, so as to ensure high speed when necessary, and to provide for a high cruising speed when only one-third of the boilers are in operation. In addition to the conning tower forward and the observer-tower aft, an under-water armour protected station is fitted, connecting electrically all parts of the vessel, and all gunnery and other stations, so that in the event of the conning and range-finding stations being destroyed, the ship would still be under perfect control from the under-water station. This, of course, will add to the life of the ship when in difficulties. The builders have utilised a special quality of steel alloy in the manufacture of the protective decks, which is capable of resisting attack from the ordinary 6-in. gun. This process is, of course, a secret one, but it has been tested with highly satisfactory results. This steel is also used for the longitudinal bulkheads, and the traverse for the 4·7-in. guns, as it has been proved an excellent security against shell fire. It is believed this is the first time steel possessing these qualities has been manufactured in England. The funnel casing of the *Rurik* are also made of this steel alloy. Arrangements have been made to provide under-water protection from torpedo attack so far as it would affect the loss of the ship. Automatic arrangements are fitted in order to prevent the ship listing over if she happens to be damaged on one side. There are no torpedo nets or booms fitted on the ship, as they have been found by experience to be a source of danger. The propelling engines consist of two sets of four-cylinder triple-expansion engines of the Yarrow Schlick-Tweedy system, each set having one high, one intermediate, and two low pressure cylinders. They are capable of developing 19,700 I.H.P., giving a speed of 21 knots, with 250 lb. of steam, and with one third of the boilers in use. There are twenty-eight separate boilers of the improved Belville type. Arrangements have been made for the use of oil as fuel. Indeed, the cruiser represents the highest naval and engineering intelligence of the day, and when she is completed in about nine months' time, Russia will possess one of the finest and most powerful cruisers afloat.

The launching ceremony was performed by Mrs. Trevor Dawson, wife of Lieutenant Dawson, one of the directors of the Vicker's Company. The launching weight of the vessel was 8,700 tons, and she was forty seconds in clearing the ways. She was pulled up within 100 ft. of the end of the launching ways, and was immediately docked in Ramsden Dock basin. She is now under the 150-ton crane in the Devonshire Dock, and is being viewed with interest, as her peculiar shape marks a new departure in naval construction.

At the subsequent luncheon, Colonel Vickers (presiding) proposed "Success to the *Rurik*," and Monsieur Balinsky, Consul to the Russian Embassy in London, replied, and proposed "Success to the Builders."

Mr. Albert Vickers replied, and said in many quarters they heard a cry for peace. In that cry he heartily joined, but he wanted to show them that that company of theirs, in spite of the fact that part of its prosperity arose from the building of warships and the manufacture of armament, was in reality, directly and truly, working towards that ideal state of things they all desired to see, namely, peace. But nations were like individuals; they must be kept in order. As they would remember in that clever little book, "Dame Europa's School," the author treated the nations as individual schoolboys in the same form. Now certain extreme parties who had that view of peace before them, could see only one road leading to the desired end, and that was universal disarmament; but in his opinion a nation could no more think of disarmament than it could think of abolishing its police force. Just as a police force existed to keep the individual in order, so the armies and the navies of the world existed to keep the nations of the world in order. Surely the deduction was clear, that until such time as they could keep in order the great cities of the world without the aid of police, it was, in his opinion, simply ridiculous to talk about the general disarmament of nations; or, to put it in other words, until such time as they could walk through the streets of London, Paris, Berlin, Vienna, and the other great cities of the world in safety without a policeman being visible, the armies and navies of the world must, and would, continue, to exist. He could not do better than close his few remarks with the old-world saying, "The best way to keep the peace is to be prepared for war."

Lieutenant Dawson, replying to the toast of his wife, who was presented with a beautiful diamond and pearl ring, said the *Rurik* embodied the skill and experience of the Imperial Technical Committee, and the handicraft of the British workman, and he hoped and believed that that great and powerful ship would not only maintain the prestige of the great Russian nation, but would be a bond of union between their two friendly countries, and that she would promote the wise policy of His Imperial Majesty the Czar in furthering the peace of the world.

THE WORKMEN'S COMPENSATION BILL, 1906.

Extension to the Mercantile Marine.

By J. Duncan, M.A., LL.B., Barrister-at-Law.

THE brave soldiers and sailors of the British Army and Navy are not to be entitled to compensation under the new Workmen's Compensation Act, which will in all probability come into force on January 1st, 1907. Theirs is the glory of bleeding for their country, theirs is the risk of occupation which the Government intends to be a special contract, so as to include the risks, quite apart from their remuneration as to salary, bivouac, kit, and canteen.

If it does happen that—

"He has left a lot of little things behind him,"

then the widow and children may pray in vain from the War Office or the Admiralty as to £300 compensation for the loss of the breadwinner. The widow of a chief engineer in the Royal Navy is entitled to a pension of £70 a year, and the children—boys till eighteen, and girls till twenty-one are entitled to what is called a compassionate allowance of £12 in an ordinary case, and in an extraordinary case, such as a child of weak intellect, it may be increased to £14, and continued for life.

In one respect, these pensions are of more value than the benefits of the Workmen's Compensation Act, insomuch as the dependants obtain a pension, although the death is not due to accident. They are entitled, under whatever cause. On completion of service, a chief engineer in the Royal Navy may be entitled to £400 a year pension.

The Mercantile Marine.

The present Workmen's Compensation Act, 1897, provides for the mercantile marine to a small extent. If a seaman has signed off his articles, and continues to work on board in a dock, he becomes entitled. For example, in an unreported case, a steward had signed off, and whilst in a dock was pitching the red plush cushion seats of the saloon cabin ashore, when he fell into the dock and was drowned. The steamship company, acting with (or under) advice of solicitor and counsel, acquainted with the law, settled the case before it came into court. The latest enunciation of the law is by the House of Lords, and one of the decisions is unsatisfactory, because it was abandoned by the respondents after the decision in the previous case, although the facts were different. These cases are as

follow:—Houlder Line, Ltd. *v.* Griffin (February 20th, 1905, April 14th, 1905; 1905, 92 L. T., 580; 1905, 7, W. C. C., 87).

The house of Lords found, reversing the decision of the Court of Appeal and sustaining the decision of the Judge of the City of London Court, that a shipowner is not the occupier of a dock, merely because his ship is afloat in it, so as to make him liable under the Workmen's Compensation Act.

The deceased was engaged as an able seaman on board the appellants' ship, and received fatal injuries while employed in clearing up a hold when the ship was moored to buoys in the middle of a large dock preparatory to going to sea.

Lord Halsbury, Lord Chancellor, said: My Lords, an accident, causing death, happened to a sailor on board his ship while he was engaged in his ordinary work as a sailor, and the shipowner is sought to be made liable, as an "undertaker," because the ship was afloat in a dock waiting to go to sea. The employment of a sailor is not one of the employments to which the act applies. [This was part of the question in dispute.] But it is argued that, because the injured man was on board a ship which was floating in a dock, the shipowner was the occupier of a dock, and as such was an "undertaker." I do not think that the shipowner was in any intelligible sense the occupier of the dock because his vessel was in the water surrounded by the structure of the dock. Although the extraordinary jumble whereby a ship becomes a factory, and so the shipowner becomes an undertaker, seems to me to be a *reductio ad absurdum*, it appears to have prevailed, and induced the Court of Appeal to reverse the judgment of the City Court Judge. I cannot agree with that judgment. I entirely agree with Lord Justice Matthew, who dissented. It appears to me that the court was misled by the case of "Raine *v.* Jobson" (3 W. C. C., 135); but in that case the persons sought to be made responsible, and held to be responsible, were persons who had hired the dock for the purpose of repairing a vessel, and whether there was a vessel in it or not, they were liable if a workman met with an accident in that dock while engaged in working there. The court then proceeded upon the assumption that the employers were in the use and occupation of a dock which they had hired; and the fact that there was the wooden structure of a ship in it being repaired, did not prevent the application of the section, which made the occupiers of a dock the occupiers of a factory, within the meaning of the Act. If, in that case, the employers had the actual use of the dock, as they clearly had, it was impossible to deny that they were the "undertakers." This is a wholly different case, and does not come within the meaning of that decision. I move, your lordships, that the judgment be reversed, and the decision of the City Court Judge be restored.

Lords Macnaghten and Lindley approved; Lord James of Hereford dissented.

The second appeal was Mack & Sons *v.* Williams (1905, the *Times*, April 15th; 7 W. C. C., 96, Menton Senhouse Reports).

The respondent, an able bodied seaman, was injured on board the appellants' steamship *Manchester*, which had finished loading in No. 1 Pomona Dock, Manchester, an open dock in the Manchester Canal. The respondent, on September 16th, 1903, was on the forward part of the ship taking in the slack of a wire rope, which was being shifted from one post to another on the quay when the accident happened. Judge Parry held that he was not entitled to compensation, as he was doing the work of an ordinary seaman. But the Court of Appeal (the Master of the Rolls and Lords Justices Romer and Matthew) reversed this decision on April 13th, 1904. The case was heard, with the previous appeal of the Houlder Line.

Mr. Ruegg, K.C., and Mr. Stewart Brown appeared for the appelants, who adopted the arguments in "The Houlder Line *v.* Griffin." There was no appearance for the other side.

It is to be regretted that the respondent abandoned this case, as the shipowner *was* in occupation of a dock, whereas the jural basis of the Houlder decision was that the ship moored in the basin was in occupation of a dock. There was no good evidence in either case as to the payment of dock dues.

Such, however, is the state of the law with regard to seamen, including marine engineers, at the present time.

Future.

But in future all seamen in the mercantile marine, including marine engineers, will come within the Act, that is, after January 1st, 1907; that is, all apprentices, able-bodied seamen, stokers, bargees, lightermen, hoymen, engineers, and officers, not earning more than £250 a year, are entitled, under the new Act, to half-pay up to £1 a week, in the case of injury, and the dependants are entitled to £300 in the event of the death of the bread-winner. The law applies on the high seas as well as within the three-mile limit.

The hazard of risks to which sailors are exposed can be understood by reference to the following comparative table:—

Table I.

Comparative statement of deaths due to accident in occupations not already included in the Workmen's Compensation Act Tatham's Tables, 1897.

Comparative Mortality Figures.

Inn, Hotel servants (London)	1,917
Dock labourers	1,829
File Makers	1,810
Lead Workers	1,783
Potters	1,706
Coal Heavers	1,528
Cutlers	1,516
General Labourers	1,509
Glass Manufacturers	1,487
Brewers	1,427
Manufacturing Chemists	1,392
Copper Workers	1,381
Wool, Silk, &c., Dyers	1,370
Seamen	1,352
Transport Service	1,216
Bargemen	1,199
All Occupied Males	953
Fishermen	845
Shipwrights	713
Grocers	664
Artisans	399

Compared with all occupied males, the mortality figure for which is 953, the different members of the mercantile marine are represented as follow:—Seamen, 1,352; Transport Service, 1,216; Bargemen, 1,199; Fishermen, 845; Shipwrights, 713.

The rates for kindred occupations in 1898 were as follow:—

Workmen's Compensation Act, 1897, Employers' Liability Act, 1880 and Common Law.

	Per cent. £ s. d.
Engineers, outside work (ordinary)	2 5 0
Engineers, bridge-building, gasometer, and other buildings	3 10 0
Lightermen (including loading barges)	2 12 0
Stevedores (excepting Liverpool)	3 10 0
Stevedores (Liverpool only)	3 0 0

The rates in some trades, such as steeplejacks, amount to £10 per cent., as distinguished from £3 10s. per cent. applied to lightermen above. In February, 1881, Mr. Neison stated, at the Statistical Society, London, that the deaths in the mercantile marine were 150 in 10,000, 80 of these being due to shipwreck. It is doubtful if 10 per cent. will cover this risk, notwithstanding that stevedores are insured for £3 10s., with a comparative mortality figure of dock labourers 1,829, as compared with seamen 1,352. There are no quotations for seamen up to the present, but they are awaited with interest.

The liability to accidents amongst seamen is high, as may be seen from

Table II.

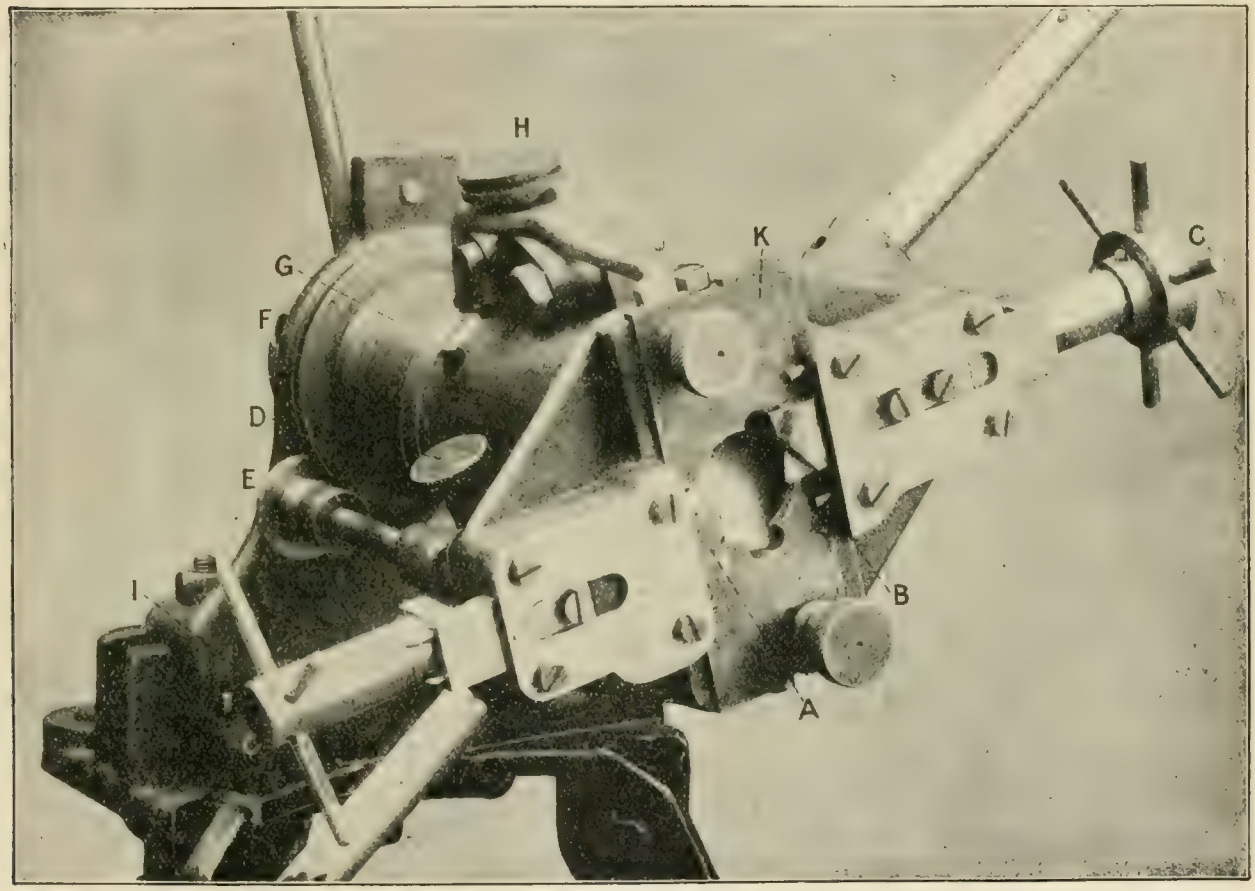
All Males	56
Bargemen	223
Seamen	202
Transport	122
Fishermen	148
Shipwrights	63

Volunteers in the Army and Navy do not fall within the Bill. It is probable that the insurance offices will undertake the risk for about 2 per cent.

A NEW TYPE OF SCREWING MACHINE.

WE recently inspected, at the Machinery Exhibition at Olympia, a machine of the above class that struck us as having many valuable features, making it suitable for use either on board ship, as taking less room than a lathe, or, from its portable character, rendering it as likely to be of service up-country, in out-of-the-way parts of the world. We illustrate the machine, which shows it standing on a tripod, but it may be made for fastening to a bench. It will be noted first that it is designed for working by hand, though it is possible to apply power if desired. A prominent feature of the machine is that it is not limited in its application, as it will equally operate upon a 12-in. pipe as upon a ½-in., thus having a sphere of usefulness comparable with what the lathe can do. The operation of the machine is not confined to screwing only, as it will cut the pipe, and it is claimed that it will do this at a direct right angle to the top of the thread, thus enabling all joints to be made with a true butt, giving a line of pipe of perfect straightness. For this and the making of screw-threads the work is held in a vice, the action of which is controlled by the nut F. Outside the main body of the machine, G, is a revolving body, shown in the figure, and fitted with two long handles, very much after the style of those of a stocks and dies. This revolving body carries all the tools required in the series of operations—the threading tool, A; the cutting-off tool, B; and the turning-down plate, K. This revolving body also carries the engaging nut, H, and the rotary guide, E.

Upon the body, G, is cut the leading thread of the machine, and all threads cut by the machine will be the same pitch as this leading screw. Bushes are provided, upon each of which there is a distinct pitch if a variation is required, and with these a corresponding tool, A, and a corresponding nut, H, must be supplied. The function of this nut, H, is to control the traverse of the revolving body when screw-cutting or turning; and when disengaged the tools can be traversed to any position for adjustment, &c. When the cutting-off tool, B, is used, there must not be any traverse of the same or of the revolving body, and the rotary guide, E, is then brought into use by the lock-



nut, D, and traverse is prevented, all tools, however, revolving freely about the work. The adjustment and feed of the tools, A and B, are secured by the hand-wheels, I and C, respectively.

The vice of this machine is said to be capable of holding any quality of pipe without in any way damaging it, and this from lead up to the hardest steel, and, as the vice is self-centring, all threads cut must be of the same pitch as the leading screw, and perfectly parallel. We have probably said enough to show, in conjunction with the illustration, that here there is a simple appliance of great possible utility, and of which we have not named all the good points. For instance, the machine will thread the end of an S bend, and will cut internal threads. It is also said to be capable of boring out and tapping. The simple

operations, however, of threading and cutting-off that we saw done were admirably performed, and we cannot speak too highly of the machine, the makers of which are the Consolidated Pneumatic Tool Co., Ltd., of 9, Bridge-street, Westminster, S.W., to whom any reference should be made for further information.

MAMMOTH DREDGER FOR INDIA.

BY the operations of a large and very powerful suction and discharging dredger named *Sandpiper* launched on November 20th, from the works of William Simons & Co. Ltd., Renfrew, the Calcutta Port Commissioners hope to remove the difficulties to navigation in the river Hooghly. This dredger, of which we give a full page view, is 235 ft. in length, and has been specially designed for the unique character of the dredging to be done on the Hooghly, and has been constructed under the direction of Anthony G. Lyster, Esq., M.Inst. C.E., Engineer-in-Chief to the Mersey Docks and Harbour Board, Liverpool, assisted by Messrs. H. H. West & Son, Naval Architects, Liverpool.

The propelling and pumping engines are placed in two independent compartments, each engine room being fitted with all the most modern auxiliaries. Propelling power is supplied from two sets of triple-expansion surface-condensing engines of the highest class, embodying all the latest improvements in marine engine practice, including steam and hydraulic reversing gear, steam-turning gear, independent circulating pumps, automatic feed pumps, feed heaters and filters, large evaporators for feed water make up, and a complete outfit of auxiliary feed and bilge pumps. Steam is generated by four large single-ended horizontal multitubular boilers constructed to Lloyd's and the Manchester Steam Users Association for a working pressure of 180 lb. per square inch. These boilers are fitted in two stokeholds, communicating with each other. Steam ash hoists are fitted in each boiler department. The collective I.H.P. of the engines is 4,500.

In view of the dredger being employed in a hot climate, special study has been devoted to the ventilation of the engine and boiler spaces. The pumping outfit placed forward of the propelling engines in an independent engine-room consists of two sets of triple-expansion engines, with independent condensing plant and circulating pumps, complete with all modern fittings. The pump engines are coupled direct to two centrifugals and pumps specially designed to raise and discharge 5,000 tons of sand per hour at the low rate of 13 per cent. of sand to 87 per cent. of water, or, in other words, the two dredging pumps together are capable of dealing with about 30,000 tons of sand and water per hour.

It was found from actual experiments that the maximum quantity of sand that fast flowing rivers can carry in suspense is 13 per cent., hence the reason for restricting the volume of sand to be discharged by the *Sandpiper* to this amount. The almost universal practice in carrying out dredging operations is to dispose of the material raised in one or other of the three following ways: (1) By discharging into the dredger's own hopper. (2) By discharging into hopper barges. (3) By discharging ashore for land reclamation. But at Calcutta it is proposed to discharge the material raised by the pumps directly into the river, the fast current of which, it is confidently expected, will convey the spoil to deep water before the sand has had time to settle. Each pump is connected to a separate suction pipe, placed one on port and one on starboard side of the vessel. Each of the suction pipes is fitted at upper end with a very massive swivel bend, which serves as a trunnion or hinge upon which the pipe is free to move, either vertically or horizontally. The swivel bends are carried in slides on the ship's side which permits of the suction pipes and swivel bends being brought completely inboard when required. Large sluice valves are fitted on the suction connections at ship's side. The suction end of each pipe is fitted with a specially designed nozzle to suit the character of the material to be dredged. A grid is fitted to the nozzles to exclude material which might choke or damage the pump. Each suction pipe is controlled by two independent derricks, one for each end, which are both worked from the same steam winch placed on deck. These derrick winches are of most massive construction, each has four independent drums arranged to work separately or together as required, for lowering, hoisting and derricking the pipes inboard. These winches form one of the most important details for the successful working of a dredger of such large dimensions and are so arranged that one man is capable of manipulating the whole of the movements.

The discharge pipes from each sand pump are carried aft under deck on each side and united into the 51-in. diameter pipe under the vessel's counter.

Special flexible connections are provided to meet the varying conditions between loaded and light draught of the dredger and floating pipe line. One of the outstanding features of the deck equipment of this dredger is the extensive and powerful installation of mooring winches, to regulate the movements in the rapid currents of the river Hooghly. The winches are placed at bow and stern and consist of two duplicate sets, each having six independent drums and two ends for warping purposes, two of the drums arranged to work chains and four of the drums are of very large diameter for working long lengths of heavy steel wire rope.

Each winch is driven by a vertical high pressure engine; the gearing throughout is of steel. A large workshop is fitted under deck, so that all general repairs may be effected on board. The outfit of machine tools is very complete, and consists of lathe, shaping machine, radial drill, etc., also smith's forge, with mechanical fan, all driven by electric motors.

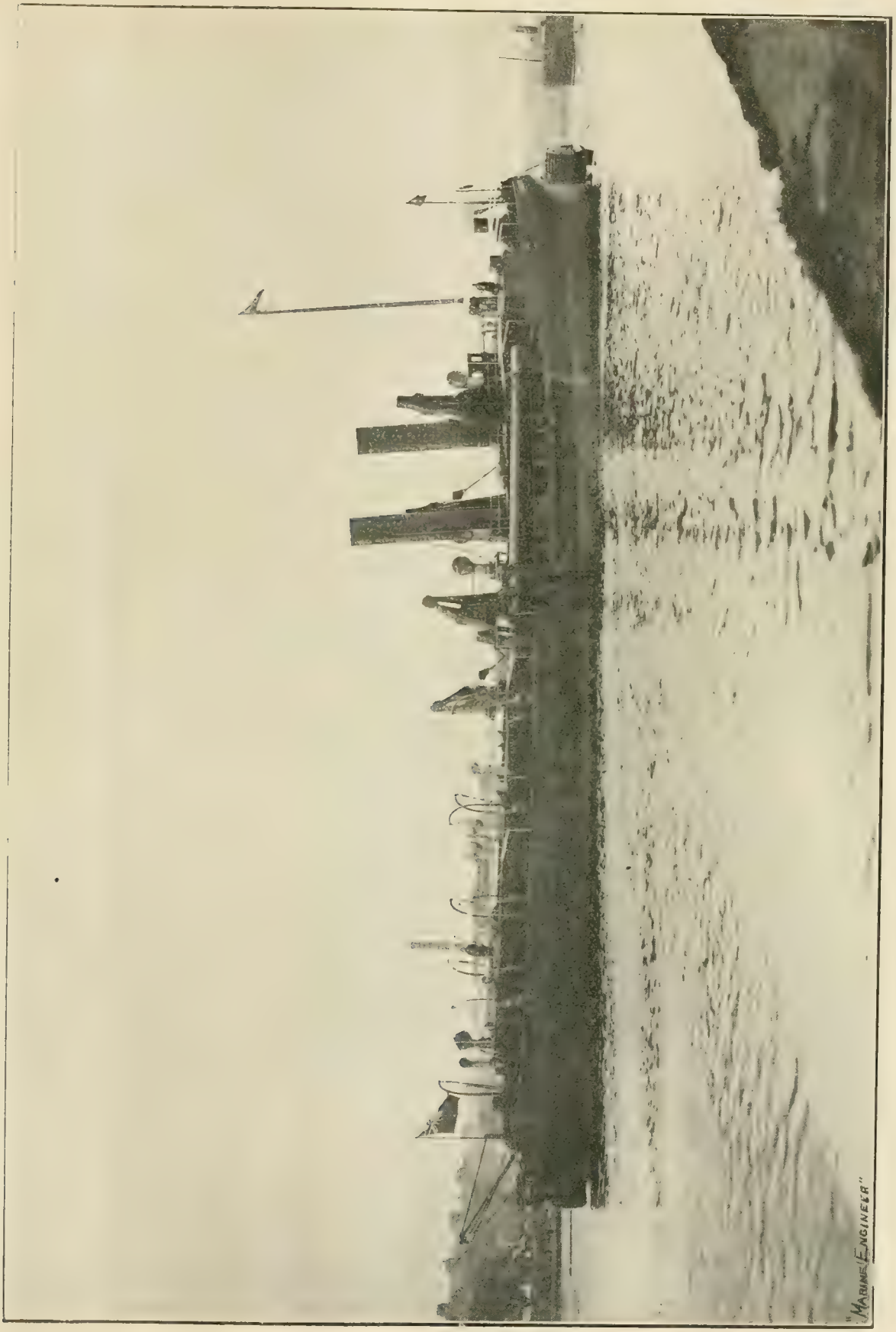
The hull and machinery are constructed to Lloyd's highest class. The deck is of steel sheathed with teak. Steam and hand steering gear is fitted, and a very complete installation of electric lighting is provided, including two search lights. Elaborate cabins are fitted up for the European officers and port officials, and provision is made for a large native crew. A refrigerating chamber is fitted up below deck for the preservation of provisions.

The floating pipe line in connection with the dredger consists of 600 feet of 51 inch diameter steel piping carried on twelve pontoons. Each length of pipe is coupled by cast steel universal joints designed to give flexibility in any direction. A steam launch is provided for general service purpose, with special apparatus for lifting and laying moorings.

English Weights, with their Equivalents in Kilogrammes.

By F. W. A. Logan London: E. & F. N. Spon, Ltd. 1906.

This is a little pocket-book, which, we should say, will prove very handy to all those engaged in the engineering trades, as it is obvious there is a greater tendency than hitherto to use the foreign designations of every kind as our intercourse abroad becomes greater. The Customs authorities require weights of goods imported to be in the native equivalent, and it becomes, therefore, a necessity to convert British weights, as demanded by each country. A series of tables, which dispenses with calculations is, therefore, of a very reliable nature for the purpose intended. They commence with a lb., and go on right through the scale, with the number of cwts. and qrs. represented in a separate column up to a ton. From that point, the table changes to that of successive cwts. up to 100 tons, which will be likely to meet all requirements, we should say. The type is quite clear, which facilitates reference, and we are able to commend the little work to all those interested.



THE "SANDPIPER," built by Messrs. Wm. Simons & Co. Ltd., Renfrew, for the Calcutta Port Commissioners.

THE SCREW PROPELLER.

V.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., &c.

IT is not now generally known, and it is therefore very fitting that it should be pointed out, that the Admiralty did, in the early days of their introduction, repeatedly make experiments with screw propellers, and our present practical knowledge of these most important instruments is almost entirely due to the experiments made with the approval and under the direction of their Lordships; and although many of these experiments, in the light of our present knowledge, were not such as we should carry out to-day, and most of them were made under conditions that would not satisfy the requirements of modern scientists, they are nevertheless of value and highly creditable to the late Engineers-in-Chief, Mr. Lloyd and Sir James Wright, as also to Mr. Trickett, Andrew Murray, and other Admiralty Engineer Officers, who in their day were not always as fully appreciated, because not so well known to the public, as they deserved to be.

As soon as the Naval Authorities were in possession of the first screw steamer *Rattler*, built for H.M. Service, they proposed to make a series of crucial tests, or at least they thought they were crucial, in order to determine the best diameter and surface of screw and then to prove that the screw was at least equal to the paddle wheel as a propelling instrument. The probabilities are that the majority of the officers engaged in carrying out these experiments were prejudiced more or less in favour of the paddle wheel, nevertheless there appears to be good evidence for believing that on the whole, these and other experiments of a like nature were carried out with quite a reasonable amount of impartiality.

The *Rattler* was a sister ship to the H.M.S. paddle steamer *Alecto*, being built to the same leading dimensions and of exactly the same form; the *Rattler*, however, had a somewhat longer stern to provide for the fitting and protecting of the screw propellor.

The principal dimensions of H.M.S. *Rattler* and *Alecto*: Length between perpendiculars, 176·5 ft.; Extreme breadth. 32·7 ft.; Mean load draught of water 13·5 ft.; Area of immersed Midship section, 348 ft.; Displacement, 1,140 tons; Area of wetted skin, 7,477 sq. ft. The engines were Maudslay's twin cylinder design of 200 N.H.P.

Number of cylinders, 4; Diameter, 40 in.; Stroke 48 in.

In the case of the *Rattler* the engine shaft was geared four to one by spur wheels to the screw shaft, while that of the *Alecto* was connected direct to the paddle shafts. Under the above conditions the *Rattler* was tried in January, 1846, when a speed of 9·639 knots was obtained on the measured mile with 437 I.H.P., the screw was a common one with two blades 10 ft. diameter and 11 ft. pitch, running at 107·9 revolutions per minute.

In the competitive trials with the *Alecto*, the ships were ballasted to a mean draft of 12·3 ft.; the first run was between the Nore and Yarmouth Roads, under steam only, with the sea smooth and the weather calm. The time taken by the *Rattler* was 8 hours, 34 minutes, and as the distance was 78¾ nautical miles, the mean speed was 9·2 knots. The *Alecto* took 8 hours, 54 minutes, so that her mean speed was only 8·8 knots per hour, but she attained that with only 281·2 I.H.P. as against the 334·6 of the *Rattler*. On this occasion a dynamometer of some kind was applied to the *Rattler's* screw shaft, so as to indicate the thrust on it from the screw. On this trip the average thrust amounted to 8,722 lb. Multiplying this by the speed in feet per minute and dividing by 33,000, it will be seen that the power exerted by the screw was 247·8 H.P.; dividing this by the I.H.P. 334·6, the efficiency is shew to be 0·74 which is a fairly high one; her speed co efficient, however, was 235 against the 245 of her opponent.

The Second Trial was made under steam and sail, the sea being smooth and the wind fair and moderate; the course was from the Yarmouth Roads direct North to a point distant 34 nautical miles. The *Alecto* arrived 13½ minutes behind the *Rattler*; her mean speed was therefore 11·2 knots, as against 11·9 knots of the *Rattler*.

A Third Trial was made, again under steam alone, but this time against a strong wind and heavy sea, on the same northerly course. The distance run on it was, however, 60 miles which the *Rattler* did in thirty nine minutes less than the *Alecto*, her mean speed being 7·5 knots against that of 7 knots of the paddle-wheel vessel. The weather and force of the wind varied considerably throughout the day and affected the two vessels somewhat differently, as might have been supposed; it is also important to note that in the early part of the day the engines of the *Rattler* were developing 364 H.P., while these of the *Alecto* were only able to exert 250 H.P., but the mean slip of the screw was as much as 42·4 per cent., while the thrust of the screw varied from 5,100 lb. to 12,740 lb.

Following this run the vessels were tried running before the wind, which still continued to be fairly strong although the weather had moderated; the speed of the *Rattler* then rose to 10 knots per hour, with a slip of only 11·2 per cent, and the power developed by the engines was 369 H.P., while the *Alecto* still failed to attain her full power as her engines only developed 292 H.P. On this occasion the thrust of the propeller of *Rattler* was measured and found to be 9,440 lb., which gave the propeller a H.P. of 290, and consequently an efficiency of 0·78.

The Fourth Trial. The ships were set on a course with the wind astern and under sail only, the paddle boards of the *Alecto* were removed beforehand, and the propeller of the *Rattler* was set vertical, and after nearly two hours' running the *Alecto* was more than a mile behind the *Rattler*, whose speed had been from 5 to 6⅛ knots.

The Fifth Trial. This was again a test under sail only, but made "on a wind," and with all plain sail set; the speed was about 3¼ knots and after 5 hours' running there was not much difference in the distance run by the two ships but the *Rattler* had edged up to the windward of the *Alecto*.

The Sixth Trial was also made under plain sail with the wind abeam, the sea being smooth and the breeze freshening, so much so that the *Rattler* attained eventually a speed of 10 knots and throughout the run of four hours made a mean speed of 8 knots and beat the *Alecto* by 38 minutes.

The Seventh Trial was to test the ability of the *Rattler* under steam only in towing the *Alecto* with her paddle boards removed, and by the log the speed was found to be about 7 knots with I.H.P. of 352, the mean thrust indicated by the dynamometer being 10,178 lb., giving a propeller H.P. of 223 and an efficiency of 0·638.

The Eighth Trial was to prove the ability of the *Alecto* to tow the *Rattler*, which she did at a speed of little under 6 knots, but with an I.H.P. less than that developed by the *Rattler* when engaged in the same work.

The Ninth Trial was the most interesting to the ordinary observer and created the greatest sensation, so much so that it has been remembered and quoted time after time since as proving conclusively the superiority of the screw. The two ships were secured stern to stern, and the engines of the *Alecto* were started first, and continued running until the *Rattler* was being towed stern first at the rate of about 2 knots an hour. The engines of the *Rattler* were then started and in five minutes her sternward movement ceased, and from that time onwards the *Rattler* towed the *Alecto* stern first against the full power her engines were capable of developing, and finally attained a speed of 2·8 knots per hour.

Now, although at the time this last trial was deemed to be a very crucial one, and its result to have been so overpoweringly in favour of the *Rattler* as to settle the question of the superiority of the screw, an examination into the real facts of the case tend to considerably modify such views, while, of course, not reversing the verdict. In no case during the set of trials did the engines of the *Alecto* develop the same power as those of the *Rattler*, and unfortunately no

* For articles I. to IV. see last four issues.

attempt appears to have been made to equalise matters in this respect as might have been done by altering the valve setting or reducing the float area. The propeller of the *Rattler* had been cut down in length previous to these trials, so that its surface was not so great as to prevent a rapid rate of revolution even when moving sternward ; and consequently when opposing the *Alecto* her engines indicated 300 H.P. with a mean thrust of 10,505 lb. and propeller H.P. of 90½, while the *Alecto's* engines indicated only 141 H.P.

Some further trials were made, of which perhaps the most interesting were those we should call now "progressive trials," wherein the ship was tried at varying reduced speeds ; these showed the efficiency to be 0·74 at 8 knots, and 0·70 at 6 knots. In a further trial between these two ships which lasted for 7 hours they were driven hard against a strong wind and a heavy sea, the *Alecto* beat the *Rattler* by half-a-mile, the mean speed of the screw vessel being only 4·2 knots, but it was in consequence of shortness of steam from having to batten down her engine and boiler rooms to keep the heavy seas from flooding them.

The following table summarises the trials of the *Rattler* :—

TABLE IX.

Trials of H.M.S. "Rattler," 1843-45. Made with Smith's Screw, 10 ft. Diameter and 11 ft. Pitch, 1·25 ft. Long, and Having 22·8 sq. ft. Surface.

	Measured Mile.	Measured Mile.	Nore to Yarmouth.	Yarmouth.	Towing "Alecto"	Progressive Trial 1.	Progressive Trial 2.
Displacement	868	1,140	1,018	1,018	1,018	1,018	1,018
Wetted Skin	6,685	7,477	7,045	7,045	7,045	7,045	7,045
Speed—Knots	10·074	9·639	9·20	10·00	7·00	8·00	6·00
Indicated Horse Power	428	437	335	369	301	205	127
Revolutions	104	107·9	94·2	103·6	96·7	84	68
Indicated Thrust	12,346	12,139	10,656	10,540	10,910	7,300	5,743
Calculated Thrust	9,121	10,100	7,482	9,026	7,921	5,929	3,662
Dynamometric Thrust			8,722	9,437	10,278	6,213	4,802
Dynamometric Horse Power			—	—	248	290	223	153	88·4
D.H.P. ÷ I.H.P.			—	0·740	0·786	0·632	0·746	0·700
Speed of Screw—Feet	1,144	1,187	1,036	1,140	1,064	925	728
Speed of Ship	1,021	977	932	1,013	709	811	608
Speed of Slip	123	211	104	127	355	114	120
Apparent Slip—Per Cent.	10·75	17·77	10·2	11·2	33·6	12·2	18·7
Effective Slip—Per Cent.	—	—	18·2	16·3	—	16·4	20·4
Dynamometric Thrust ÷ I.T.			—	0·818	0·895	0·943	0·851	0·837
D.H.P. ÷ I.H.P.	217	224	235	277	—	252	172

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

WHATEVER may be said to the contrary, turbines are not only finding a footing for marine driving, but also for electrical purposes ; but, as brought out in a recent paper on the subject, there are several peculiarities resulting owing to the high speed of the turbines. It was shown that with a machine running, say, at 3,000 revolutions per minute, a commutator of 10 in. diameter might very well have a surface speed of 7,584 ft. per minute ; but as at these high speeds centrifugal forces are enormous, special means have to be adopted to prevent the segments of the commutator from flying apart. To obtain sufficient contact surface for the brushes, the commutators are very long, usually about 18 in., and four shrunk on steel strings are employed for keeping the segments in place. With the high speeds carbon brushes are not satisfactory, as with ordinary pressure they chatter with any inequality of surface, and if higher pressures are applied the surface of the commutator will be smeared by a soft carbon, and a hard one will score it into ridges, and in both cases there will be heating. It must not be supposed, however, that some endeavour has not been made to get over the difficulties of carbon brushes, and in one make there is an invisible grain longitudinally to reduce the heating. Resistance is also lessened by introducing during manufacture finely divided copper into the carbon. A point in favour of carbon brushes appears to be that sparkless commutation can be obtained with them in a fixed position between quarter load and an overload of 5 per cent., whereas with metal brushes at full load, it was necessary to give the brushes a lead of 3 in. in advance of their position of no load. The question of ventilation, so important in these high speeds, we will not enter into here, also the factor of the quantity of metal for the work turned out, but it is sufficient to say that it appears to be verified that the electrical power developed due to the high speed of the surface over the slow running machines is somewhere between two and three times per cubic inch of metal employed. This is the result that is come to in the paper to which we refer, and, if correct, apart from the question of the action of the steam in the two types of engine, it is clear there is a considerable gain to be noted.

Wireless telegraphy has been prominently before the public recently in more ways than one, but we will stop to notice only certain improvements devised. One is a new receiver by Dr. de Forest, in which an incandescent lamp is employed enclosing two platinum wings parallel to the plane of the filament, and about 2 mm. on each side of it. There is no connection electrically between the two, but a positive leakage is found to occur from the wings to the filament, and the instrument is found to be an extremely sensitive detector of Hertzian waves, giving responses several times as loud as any other form of wireless receiver subjected to the same impulses. The arrangement is said also to be very selective as regards its sensitiveness to waves of different lengths, and it can be closely tuned with the syntoniser. The device seems to be one in a new field entirely, and worthy of note accordingly. In a report from the United States of trials of the Stone system, which was installed on a tug at some yacht races, two flag-poles 25 ft. high were installed on the tug 30 ft. apart. Horizontal antennæ were suspended between the two masts and brought down into the engine-room, where the wireless apparatus was located. On shore a 50-ft. mast was employed twelves miles away, and the Boston Navy Yard was in connection with Portsmouth and Cape Cod stations and with warships in proximity to the racecourse. While the Navy Department uses a wave length of 450 m., the tug and yacht club worked with one of 300 m. only, and it was found that at no time was there any interference, owing to the high degree of selectivity of the Stone system. The total average words sent was 22·9 words per minute, the results being described as exceedingly satisfactory.

An ingenious form of hoist has been patented in the United States, in which the armature and the drum have the same centre, the drums being the field. The two, however, have a different speed given by gearing, the armature revolving at a much greater speed. The design is intended to accomplish an economy in weight in proportion to power. All strains are central, and it is stated there is not a single cross-strain on the machine. The efficiency of the motor is so proportioned to its duties that overload cannot occur. In thirty seconds the full lift of 20 ft. is accomplished. Certainly a most ingenious method of hoisting this appears to be, and one quite novel, as well as simple, from the drawings before us.

DEVELOPMENT OF THE MARINE STEAM TURBINE.*

BY THE HON. C. A. PARSONS, C.B. (Past President), AND MR. R. J. WALKER.

(*Continued from page* 121.)

THE vacuum augmentator has now been fitted in several vessels with with very good results.

As an illustration of the importance of high vacuum, Fig. 6 shows the energy of steam that can be utilised in a steam turbine as compared with a reciprocating engine.

Another point which has often been referred to in connection with turbine machinery is the question of boiler pressure. The effect of difference of boiler pressure between 150 lb. to 200 lb. is relatively smaller with turbines than with reciprocating engines, and it is very questionable, in the majority of cases, whether the saving in coal by the adoption of high boiler pressure would justify the increase. More especially is this the case in moderate-speed vessels. In moderate-speed vessels, to obtain reasonable propeller efficiency, a certain diameter of propeller is necessary, and the revolutions to correspond are moderately low. It is necessary to obtain a certain surface speed of turbine, as well as a certain number of rows of turbine blades, to obtain reasonable economy. The diameter of the turbine, therefore, becomes greater in proportion to the power, and the blade heights in the annulus between the drum and the casing are relatively shorter; this gives a relatively greater clearance loss.

The clearance area is practically constant for a given diameter, so that with higher pressures and denser steam the loss through clearance space will be greater.

Another point which has been greatly discussed in connection with turbine machinery is the question of the method of measuring the H.P. developed by the turbine engines. As is now more or less generally known, it is not possible to indicate the power of the turbine as in the ordinary method of the indicator diagram of reciprocating engines, and, in the absence of any such method, it is found most convenient to take the estimated I.H.P. as the equivalent I.H.P. which would be required with reciprocating engines for the particular class of vessel proposed. Messrs. W. Denny & Bros. have recently introduced a new dynamometer, or torsion meter, for obtaining the power transmitted by the shaft, the readings being obtained by the torsional deflection of a given calibrated length of the main shafting. This instrument has been used on several vessels, and appears to give very reliable results, and, where facilities are at hand for obtaining the effective H.P. by means of tank experiments, the shaft H.P., together with the effective H.P., form a very good basis for estimating propeller efficiency..

Other advantages incidental to the turbine might be cited, such as reduced weight of machinery, steadiness and smoothness of running, reduction in oil and stores, and absence of racing in a sea-way, and other advantages which have brought the turbine to a commercial success.

The development of the marine turbine has taken place almost entirely in Great Britain. A few war vessels have been built in France and Germany. The reason that the Parsons marine turbine has made so little progress on the Continent in the past is probably due to the fact that in France and Germany rival turbine systems of local origin have been energetically exploited, inducing those responsible for the ordering of new vessels to defer the adoption of a new system until the claimants had results to show.

The Parsons turbine was introduced to the Continent by the small French torpedo-boat No. 293. This boat, ordered by the French Navy as an experiment in the year 1903, has been in continual service for over two years without any breakdown or repair, and continues to give in practice the results obtained on trial. Naturally, so small a boat hardly demonstrates the results which might be expected from larger installations. The above-mentioned experimental torpedo-boat is 130 ft. by 14 ft. beam, and 95 tons displacement. She attained a speed of 26·2 knots. The arrangement of machinery is similar to that in the *Turbinia, viz.*, three turbines in series.

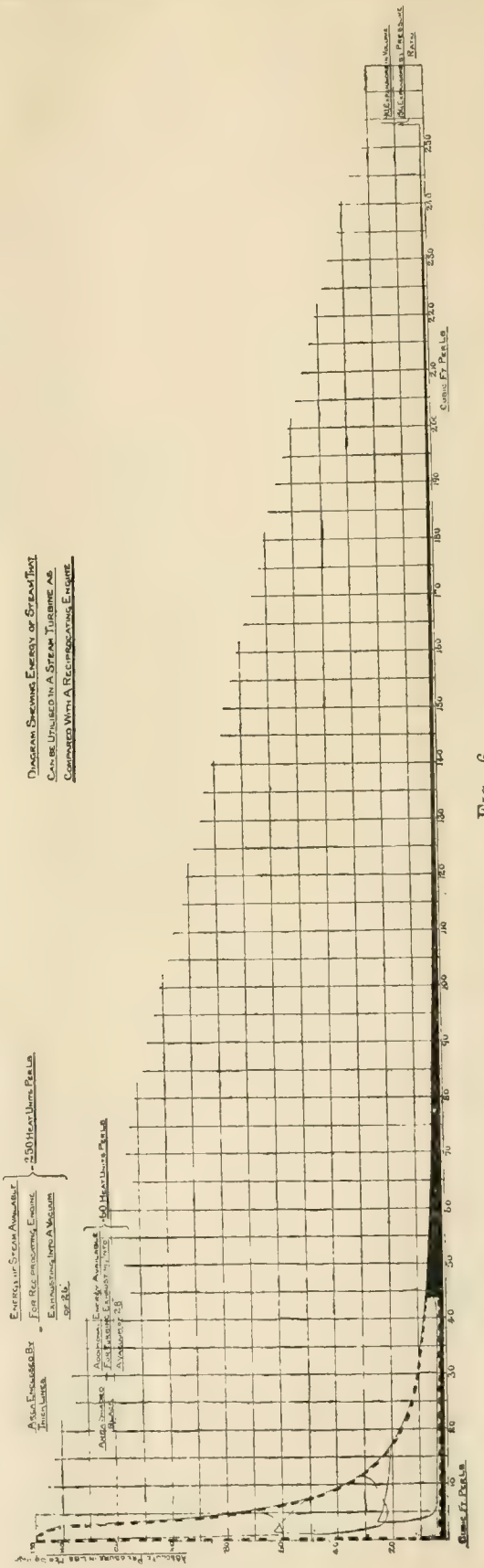


Diagram Showing Energy of Steam That Can Be Utilised in A Steam Turbine As Compared With A Reciprocating Engine
Energy of Steam Available For Reciprocating Engine Exhausting Into A Vacuum of 26"
250 Heat Units Per Lb.
Energy Available For Parsons Turbine Exhausting Into A Vacuum of 26"
150 Heat Units Per Lb.
Area Enclosed By Indicator
Cubic Inches Per Cubic Foot Per Lb.

FIG. 6.

* Read at a meeting of the Institute of Marine Engineers, at the Engineering and Machinery Exhibition, Olympia, on September 29th, the Right Hon. Lord Pirrie in the chair.

In France a mail and passenger boat is being built for the Marseilles and Algiers service of the Compagnie Générale Transatlantique. She is 378 ft. by 43 ft., and is designed for a service speed of 20 knots.

In the States five passenger vessels are being built, and a scout-cruiser, of 24 knots speed, for the U.S.A. Government, to be fitted with Parsons' turbines.

Parsons' turbines fitted to vessels in this country represent a total H.P. actually completed of about 280,000 I.H.P. The total H.P. of marine turbine engines completed and on order with the Parsons' Marine Co. and their licensees is over 870,000 I.H.P.

THE ADVANTAGES OF A TECHNICAL SOCIETY.*

BY THE HON. SECRETARY, MR. JAMES ADAMSON.

IT is probably not necessary nowadays to preface the subject introduced in the above title, by advocating that there are advantages accruing both to the national and individual life, directly and indirectly, in connection with technical societies. The fact that the leading men of the age, and the highest intelligences in the scientific world of thought and action, are associated with one or more of such societies, is sufficient evidence.

In the ages whose scrolls have been rolled up and whose records have been handed down to the present generation, we find that witnesses have ever lived to show to their fellows how the forces and products of the universe could be courted and brought into use for the service of man. The methods adopted by these witnesses to proclaim the results of their discoveries and investigations, and even to pursue them, have differed widely, due to the surrounding circumstances over which in some cases they had no control, and in others where the methods were adopted from choice or self-protection. Illustrations of these different methods will readily occur to the memory from history and observation, whether as regards the former we look into the times before or after the Christian era, or as regards the latter, into our own times, when we have the perpetual motivist and the astrologer still in evidence.

In thinking backwards to trace the probable founder of the first technical society, the name of Seth suggests itself, as we read that he and his family applied themselves to the study of the science of astronomy, and appear to have been men of liberal minds, from the references made to them and to the memorials they are said to have erected on which to record their transactions and preserve for the guidance of others the knowledge they had gained of the heavenly bodies. Contemporaneous with Seth, doubtless, others were working on similar lines in other directions, as, for instance, in Music, Metallurgy, Architecture, &c.; in connection with these occur the names of Jubal, Tubal Cain, and, later on, Nimrod. Seth and his family may thus be said to have founded a school or society for technical research in Astronomy, and they are stated by Josephus to have used pillars of brick or stone, on which to record their transactions, in order that those who followed them should learn what had already been done, and begin where they had left off. Although Josephus states that the pillars on which were inscribed these records were extant in his day in the land of Siriad, the pillars referred to are considered by antiquaries to be of later origin, probably the time of Sesostris of Egypt. It would be of great interest to know how far the family of Seth penetrated into a knowledge of the heavens, and what they had gained in their observations of the solar system and the shape of the earth.

It is evident that many theories and much confusion existed in later times on the subject. It was a wonder to the writer, in the days of youth, why the discoveries and knowledge gained by early astronomers were covered up by succeeding generations and erroneous teaching substituted on matters, not of speculation, but of fact. An illustration of this occurs in connection with the shape of the earth, which in the days of David and Solomon is referred to as round, yet about 2,650 years later Galileo, in 1633 suffered for proclaiming such an idea as that his discoveries confirmed the Copernican as opposed to the then approved Ptolemaic theory.

An offshoot from the astronomer who entered upon his study of the science from a wondering admiration and love, was the astrologer whose aims were to turn to more personal account the occultation of stars, and the ignorance or credulity of the people, the essential difference of the two types reared from the same root being on the part of one to enlighten the community, on the part of the other to darken the discoveries of science, or at least to cloud them from their true significance.

It would be profitable, were it possible, to trace the progress made in the arts and sciences step by step, and note the advancing waves of progress, with the sets back from time to time, by the selfishness, grossness, and covetousness of one generation and another. We know sufficient, however, to cause us to wonder what influences were at work in the different ages to not only check progress, but to actually overthrow what had been done to advance man's knowledge of the universe and of the forces of nature, gained by the adding on of successive generations, the constructive forces or agencies and principles of life in one age being met by the destructive tendencies of a succeeding one. Such are ever at work in all generations; we see them in our own age, around us, and can gauge to some extent the agencies at work; the resultant, however, in direction and force remains to be worked out, when the generation engaged in the struggle of good and evil has run its course.

We can well understand the difficulties experienced by the scientists of hundreds of years ago, and appreciate the disadvantages under which those of thousands of years ago laboured. We owe a tribute of thanks to them, as their patience and painstaking work has rendered possible the discoveries and advantages we ourselves have witnessed and taken part in. When we try to imagine what it meant before the days of the telescope, to study the heavenly bodies and note their movements, the enthusiasm and eagerness of the students must strike us as being beyond ordinary. The steps which can be taken now by a student in any of the sciences or arts with ease had to be laboriously trod, and that, too, after as many years of close work as it now takes days or hours.

Doubtless the barbarisms of war and bloodshed had something to do with stemming the waves of progress from time to time, but other influences were at work as when the discoveries of Galileo were proclaimed less than 400 years ago. As to the effects of war, Ruskin has even declared that war has proved to be a handmaiden to advancement in civilising influences in respect to art and culture, and that not on account of clearing the ground for civilisation to enter in and possess conquered territory, but as directly elevating those engaged in it, and inducing the cultivation of the arts and sciences among warlike nations. The ethics of this reasoning from historic facts brings us to an oft-repeated warning that idleness, or peace and luxury, lead to gross selfishness and vice, and with this aspect of it we may agree, whatever attitude of mind we may adopt regarding war and those who are responsible for or are engaged in it. The days of chivalry were undoubtedly productive of noble aspirations and sentiments, and left their mark on succeeding generations, not only in respect to the lives of the people, but in song and story, up to and including the inimitable work of Cervantes, where the spurious and unreal are held up to view in fascinating tale.

When the light of the nation is curtailed by a heavy war cloud and the sinews of her sons are girt about by trappings for the fight, there is a temporary lull in respect to the more peaceful requirements of everyday life, and probably sentiments of patriotism and brotherhood are kindled anew among a large section of the people, while deeds of daring, of enterprise, of humanity, from the field of battle, are recorded, the latter being due to other thoughts than those involved in the barbaric idea of carrying out to the bitter end the wailing cry of *Vae Victis*, each and all tending to rouse feelings which otherwise might lie dormant and then die. We can realise how hateful to a man, whose inner life has been stirred by noble thoughts and sentiments, the sight of sordidness and evil becomes; the revulsion of feeling tends to quicken that man's taste and desire for the beautiful.

The conclusion of peace and the recovery of the nation from the immediate results and losses of war bring about a revival of the peaceful acts of commerce and trade. The man of science steps in to occupy the land but lately devastated with the horrors of a campaign, seeking to extend the earning power of the people by introducing machinery adapted to the needs of the climate, to the natural wealth in agriculture or in minerals, and so prepare the land for a people that should occupy it and prosper.

* Read before the Institute of Marine Engineers, at 58, Romford-road, Stratford, E., on October 1st. Chairman, the Right Hon. Lord Pirrie.

The alchemists of the Middle Ages in their researches worked amid close surroundings in order to preserve their secrets, each forming a one member society, or admitting others as necessity might demand, to enable them to carry out their investigations, and when the results were attained, the sooner the obituary list contained those whose services were no longer required the better; the desire and aim of the original promoter not being to proclaim his discoveries, but to make use of them for his own personal ends. There were exceptions to this view and habit of mind, but no doubt many discoveries made in this way were lost for the time being, when the alchemst himself followed his assistants, without leaving records behind.

This order of things has changed now; a scientific discovery is proclaimed to the world, and for the mutual advantage of all, while its merits are discussed and papers read before the different societies interested specially in the discovery, and the members of which are then all more or less enlightened in the subject. The hall of the scientific society has thus taken the place of the alchemists' cave and secret laboratory, while the critical discussion has to some extent superseded the crucible. The change is an advantage to the community, as discovery and improvement are not confined to the painstaking few, but are proclaimed for the benefit of the many.

The advantages to the nation by this change are great, in that the discoveries and improvements made from time to time are brought before the members of the technical society under whose auspices these most fittingly fall, are discussed, and afterwards incorporated into the national life, with further suggested thoughts and improvements, so that all have an opportunity of working out both from the root idea and the various branches or modifications dealt with in the discussions.

It may be said, from the narrow and selfish view, that the transactions of the various societies are proclaimed abroad as well as in the particular home of the society; therefore, the benefits are not confined to the members, but are given to the world. While it is true that the foundation principle is largely altruistic, it is so in the interests of the members as well as of the business to which they belong, also in a more extended sphere in the interests of the nation; and in connection with this latter, the words and sentiments given by Sir Walter Scott in the scene between Fitz-James and Roderick Dhu, by Macaulay and others, of both modern and ancient times, occur to one with a consciousness that no man, even if he could, should live unto or for himself alone, or even aim at doing so.

The technical society gives a refinement not only to the particular culture with which it is associated, but to the members who assemble under its asupices, adding that courtesy and grace which facilitate business, and keep sweet and in good order the wheels of daily life. A feeling of *esprit de corps* the expression is used for want of a better in our own tongue is engendered and encouraged, as it ought to be, where there is scope for it in every line of life, and most certainly in the various branches of engineering. In its wider and more general sense this comes into our national life as patriotism, a feature of which, however, or it may be more accurately described as akin to it, with the instincts of tradition warping it, is the result designated clannishness. Another feature of kinship is in trades-unionism. Either of these, when carried out on extreme lines, is detrimental to the best interests of the community, by twisting the mind and giving a bias to conclusions unwarranted in the nature of things, although each contains elements of good if balanced by sound judgment.

Technical associations are composed of members who are united together for the purpose of enlarging their sphere of usefulness, in their own particular walk of life, to the nation of which they form units, by increasing its capabilities, by discovering new and better methods of work to economise time and labour. By the aid of such each member adds his own quota of discovery, research, and experience to, and for, the common good of all concerned.

The searches for the philosopher's stone and the elixir of life were carried on in dark corners and by hidden ways, as already mentioned, each searcher retaining the secrets he discovered and hugging them close, lest he should be deprived of the fruit of his labours.

Now the fashion is, for those who consider they have discovered the modern equivalents of those desiderata, to proclaim the fact aloud from platform and rostrum with much energy, giving the results of their searchings—sometimes with a view to coerce the public mind into line with their own—and that with varying motives, and with arguments based upon an inexact science, thus introducing premises of an unstable nature on which to build. Careful thought and discussion on technical details are calculated to train the mind to sift evidence and deduce conclusions from rational bases.

Years ago, when every trade had its own guild and close corporation, the secrets of each were kept closely, but with the advancement of time, new forms of industry came into being, with different views of duty and broader principles of life; societies were formed, and their number has been gradually increased year by year. These have taken the place to some extent of the old guilds, and with a somewhat different system of policy—wider and more beneficent in their nature.

The advancement and progress of the nation are within the scope and endeavour of such associations, of their meetings held to consider and discuss papers dealing with everyday practice, and if in the result of these deliberations, time, labour, or material in daily work is saved, whether for individual employers, companies, municipalities, or the State itself, the national force to compete with other nations in the commerce of the world is being strengthened.

The nation that can afford to improve its methods and its means of manufacture and gauge commercial undertakings, not only from a personal and present, but a prospective standpoint, is in a better position than one compelled to cling to the methods of past years, and consider first of all immediate cost before prospective gain. Thus, the manufacturer who is induced to change the methods, traditions, and the machinery which served his forefathers, and adopts improvements, is in a better position to hold his own than one who will not do so. Illustrations of this are not wanting, and the results are obvious. The methods and appliances of one generation may be quite unsuitable for the next, and recent reports and discussions go to show that this applies to agriculture as well as to machinery and manufactures, and, indeed, trade and commerce generally.

The philosopher's stone is commerce in the present day, and the elixir of life is improvement; the combination is supremacy to the individuals and the nations who reach the best combination.

To the apprentice, especially to one who takes an interest and pride in his work, the technical society ought to appeal, in that it affords him an opportunity of getting into touch with the results of experience direct from the lips of those who have passed through a course of training such as he himself is looking forward to, and by so getting into touch with those who have this experience, he is able to form conclusions and make deductions—a mental exercise he would otherwise find it impossible to gain. He has during his apprenticeship to attend technical classes, either in the evening or by special arrangement during the day, as is allowed now by many employers, and necessarily his time is so occupied that he cannot give much attention to the meetings and proceedings of technical societies.

(To be continued.)

Institute of Marine Engineers.—As an outcome of the Engineering Exhibition held at Olympia, this Institute has forwarded the under-noted amounts as donations from the benevolent fund formed in connection with the winding-up of the Exhibition accounts: Merchant Seamen's Orphanage, £15 15s.; Infant Orphan Asylum, £10 10s.; Caledonian Orphan Asylum, £10 10s.; Scottish Corporation, £10 10s.; West Ham Hospital, £2 15s. It is highly gratifying to note that the Exhibition was carried to so successful an issue, and that the funds admitted of such donations to these noble institutions. The organisers are to be congratulated.

The new steamer *Rohilla*, built by Harland & Wolff for the British India Steam Navigation Co., arrived from Belfast towards the end of November, to take the sailing for Calcutta, with passengers and cargo, on Saturday, December 8th. She is a fine vessel, well fitted and equipped throughout as a first-class passenger steamer. Both builders and owners are to be congratulated on her fine appearance. The *Rohilla* is almost a sister ship to the same company's steamer *Rewa*, built by Denny Bros., and now on an Eastern voyage. As the latter steamer is fitted with turbine machinery—as noted in the paper by Messrs. the Hon. C. A. Parsons and R. J. Walker, published in our November issue—and the former with twin sets of quadruple reciprocating engines, the results will be of considerable interest to Eastern travellers. These steamers were referred to in former issues at the dates of launching.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

THE strike of Clyde shipbuilding operatives—members of the Boilermakers' and Iron and Steel Shipbuilders' Society—which had lasted for seven weeks, was brought to a termination on Saturday, the 17th ult., the day on which the threatened lock-out of all members of the society—boilermakers as well as shipbuilders—was to take effect. Advised by the representatives of the federated trades who had had conferences with the officials of the employers' organisations, and with the delegates of the men on strike, a ballot of all the strikers was taken on the 15th and 16th ult. The result of this was that on the night of the 16th it was intimated that of 4,130 men who voted (out of a total of 5,000), 2,499 were in favour of resuming work on the old terms, and 1,631 were against resumption. The majority for resuming was thus 868—a distinctly clear finding—and the officials of the employers' federations, on being informed of the decision to resume work, promptly made arrangements to cover up the notices of the lock-out, with others intimating that owing to the decision of the shipyard men to resume work the lock-out would not be enforced. A short consultation was also held to consider the arrangements for the resumption of work, and it was agreed that in order to give time for the shipyard departments being brought into proper working order again, and to enable the squads of workmen themselves—platers, framers, riveters, caulkers, &c.—to engage their helpers, &c., a general resumption would not take place till Wednesday, the 21st ult.

The question before the men was the simple one of resuming work on the conditions and wages prevailing before they came out on strike seven weeks ago, coupled with the clear understanding that there is to be no alteration of wages before the end of March, and that if either employers or men desire a change at or after that time, a conference will be held on the suggestion of either side about the middle of March. Although the majority of the men who had been actually on strike did not re-start until Wednesday, many of the other men who had been thrown idle by the strike were started earlier, while others did not obtain work for some time after; in fact, owing to the state of trade, some of the firms have not yet been able to find employment for as many men as they had previous to the strike. Matters, however, will gradually settle down to what would have been the normal conditions in the present state of trade if there had been no ill-advised stoppage of work.

Activity in launching new vessels, and in testing the speed of others, have formed quite a feature of Clydeside industry during the first half of November. Five steamers, for example, were launched within as many days, while other important consignments to the waters of the Clyde were made before and since that period. Amongst the vessels sent off the stocks mention may be made of the twin-screw steamer *Opawa*, of 460 ft. length, launched by Messrs. William Denny & Brothers, Dumbarton, for the New Zealand Shipping Company, Limited, London; the *Magadala*, of 450 ft. length and 4,850 tons gross, by Messrs. David and William Henderson, for Messrs. Maclay & McIntyre, Glasgow; the *Frankdale*, of 400 ft. length, and 4,950 tons gross, and 8,000 tons deadweight carrying capacity, by Messrs. Charles Connell & Co., Limited, Whiteinch, for the Palace Shipping Company, Limited, Liverpool; the *Kenton*, of 430 ft. length, 4,750 tons gross, and 7,800 tons deadweight carrying capacity, by Messrs. William Hamilton & Co., Limited, Port Glasgow, for Messrs. Japp & Kirby, Liverpool.

A further notable launch was that of the dredger *Sandpiper*, sent to the stocks of Messrs. William Simons & Co., Limited, Renfrew, to the order of the Calcutta Port Commissioners.

Of trial trips, which have also been numerous, reference may be made to that of the twin-screw steamer *Titan*, built by Messrs. David and William Henderson & Co., Partick, for the Ocean Steamship Company, Liverpool (Messrs. Alfred Holt & Co.), which is about 9,000 tons gross, and intended for the owners' Eastern trade, together with a sister-ship, the *Cyclops*, recently completed by the same builders. These vessels form a departure from the ordinary type of cargo steamer, as regards the hold-pillaring, and the masts, and derricks, and deck equipment generally, the features of which are now growing in favour amongst owners of cargo-carrying vessels purely. Another noteworthy vessel tried was the *Denbigh Hall*, of the Hall Line of the Ellerman Lines, Limited, built by Messrs. Barclay, Curle & Co., Whiteinch. This is one of a large number of similar vessels built during the last few years, to the order of Sir John Ellerman, Bart., many of them by Messrs. Barclay, Curle & Co. The machinery, constructed by the builders, consists of one set of triple-expansion engines, with boilers worked under Howden's forced draught system, designed to give the vessel a speed of 11 knots.

Messrs. William Beardmore & Co., of Dalmuir Shipyard and Parkhead Steel Works, in accordance with the shipbuilding programme of the recently constituted and registered Australian Mail Liners Syndicate, Limited, will build and engine two of the eight steamers with which the syndicate will carry on a mail and passengers service between Britain and Adelaide, aided by a subsidy from the Government of the Commonwealth of Australia. The other six steamers are to be built as follows: Two by Messrs. Vickers, Sons & Maxim, Barrow-in-Furness; two by Sir W. G. Armstrong, Whitworth & Co., Newcastle; and two by Sir James Laing & Sons, Sunderland. They are to be twin-screw steamers, 560 ft. in length, 62 ft. beam, and 32 ft. 9 in. depth. Their deadweight carrying capacity will be 7,500 tons, and refrigerating accommodation will be provided in each for 4,000 tons. Their speed is to be about 18 knots, and each will have passenger accommodation for about 370 first and second class, and 500 third-class. The syndicate starts with a capital of £50,000, in £1 shares, and there is no initial public issue. It is obvious, however, that not many steamers, such as are outlined, can be provided for £50,000. Indeed, as the eight vessels are estimated to cost about three million sterling it would appear that a public company will be issued later on.

Messrs. Beardmore & Co., at their Parkhead Forge and Steel Works, have completed and despatched to Japan the forgings for the machinery of the new Japanese battleship *Yotsuma*, launched at Yokohama on the 15th ult. It may be noted in this connection that an interesting departure has been made by the Japanese Admiralty, in having the forgings of the shafting and cranks made of fluid-compressed nickel steel. In the mercantile marine, and even in the British Navy, as a general rule, constructors have been content to have them made of ordinary mild steel. Fluid-compressed nickel steel represents the highest quality of metal best adapted for resisting strain. The nickel imparts greater toughness, while its preparation under the fluid-compressure process renders it free from all possible flaws. Messrs. Beardmore & Co., it may be added, have shared to the extent of about a quarter of a million sterling, in the highly important order recently given out to the leading armour-making firms for the plating required in the construction of the three new battleships of the "Dreadnought" type.

Messrs. William Denny & Brothers, Dumbarton, have received orders from Messrs. Takata & Co., merchants and shipowners, Japan, for two powerful ocean turbine steamers for the Eastern trade.

Messrs. Hutson & Sons, Limited, engineers, boilermakers, Kelvinhaugh, Glasgow, have secured the contract for a steamer of 150 ft. in length, intended for the Chilian coasting trade, the hull of which they will have constructed by another firm, they themselves providing the machinery.

Mesrs. The Ailsa Shipbuilding Company, Limited, Troon and Ayr, have been commissioned by Messrs. David MacBrayne, Limited, to build two new steamers for their West Highland passenger and goods service, one of which will be built at Troon and the other at Ayr. One of these will be propelled by motor power, which is a new departure from anything of the kind found in use for express and passenger service at sea. The other will be a large and powerful screw steamer for the West Highland trade, with every modern improvement introduced on board. These two vessels, in conjunction with the seven added to MacBrayne's fleet within the last two years, will enhance considerably the efficiency and attraction of the services so long carried on in the waters of the West Highlands and the Hebrides.

Messrs. Lobnitz & Co., Renfrew, early in November, put through successful trials, the powerful screw tug *Roberto Nunez*, which they have built to the order of Messrs. Pearsons & Sons, for the Teheuntepec National Railway Company. This Renfrew firm have also recently shipped a complete set of their patent rock-breaking machinery for the excavation of rock under water at the port of Bari, Italy, similar in power to two sets shipped by them to New York.

THE TYNE.

(*From our Own Correspondent.*)

Shipbuilding.—The news of the Clyde settlement was received in this district with great satisfaction, as the incident tended greatly to allay the fears that existed with regard to the possibility of a general lockout taking place. This danger, however, cannot be said to be, as yet, absolutely removed for business in the important yards, at the Hartlepools and on the Tees, is still partly suspended through a dispute with the platers (members of the Boilermakers' and Ironshipbuilders' Society) on the question of piece-work prices. Unless the platers very speedily come to terms with the employers in the Tees and Hartlepool district, the dispute, which, up to the present, has been localised, will, in all probability, be extended to all the yards on the North-East Coast. That is, no doubt, a remote contingency, and the fear of such an addition to their responsibilities will perhaps induce the Executive Council to bring pressure to bear upon the platers in the district to which the trouble is at present confined, with a view to get the latter to accept the masters' revised scale of prices, which are understood to be quite equitable. The boilermakers of the Clyde have been brought to reason by firmness, and we take this as a hopeful sign that their confrères on the Tees will be brought to a more pacific frame of mind by adherence to the same policy on the part of the employers in the last-named district. We therefore have no fear in expressing the anticipation that before the middle of December peace will be established throughout the whole of the districts of the North-East Coast, and the platers of the Tees and Hartlepool will have been taught a lesson which may make them more careful in the future about entering on a quarrel.

The outlook at Messrs. Armstrong, Whitworth & Co.'s Elswick yard has improved greatly since last month, three additional keels have been put down, making four vessels on the stocks, which include, of course, the warship that was laid down early in the year, and is now well advanced. The making of the new building berth is being pushed on with great energy, and the general impression among business men who happen to be interested in the company's affairs is that an order has been secured for an exceptionally important vessel to be laid down in this berth. The other departments of the great Elswick establishment are also showing improved business, and many of the operatives who were suspended earlier in the year are now reinstated.

Messrs. Wood, Skinner & Co. have within the past month launched two vessels—one for Norwegian owners, and one for a Newcastle firm—and we are pleased to note that the firm have still a fair amount of work in hand. At Messrs. Dobson's yard, Low Walker, one or two berths are vacant, and at the other yards in the same locality there are also to be noticed some idle berths. Messrs. Swan, Hunter & Wigham Richardson's Wallsend yard maintains a satisfactory show of briskness, nearly all the building spaces being utilised, and there is a large force of men engaged in the finishing work of the s.s. *Mauritania* in the water.

The two yards at Hebburn are kept going steadily, the amount of work in hand, in each case, being considerable. Some very important repair contracts have been carried out in Messrs. Stephenson's large graving dock during the last couple of months, and it is understood that there are other engagements which will keep the dock constantly occupied during the winter months.

The Palmers Company are reported to have secured some orders of exceptional importance, and it is hoped that the remainder of the winter season at this centre will be more prosperous than was anticipated. The Tyne Iron Shipbuilding Company, Wellington Quay, have their three berths occupied, and Messrs. Clelland's repairing establishment in the near vicinity is being kept pretty busy. The yards at Tyne Dock and Shields are still fairly well off for work, and the majority of the graving docks are occupied with vessels undergoing more or less extensive repairs.

Engineering.—The demand put forward by the engineering operatives some weeks ago for an advance of wages has, as we anticipated, been permitted to lapse, and it is not likely that this question will again be raised until trade improves in a very unmistakeable manner.

The interesting announcement has been made that among other orders recently booked by the North-Eastern Marine Engineering Company, Wallsend and Sunderland, is one for six machinery equipments for steamers to be built at Antwerp. The Wallsend Shipway Company have a good deal of work in hand, the most important contract being, of course, the engines, &c., for the great liner now getting fitted out at Messrs. Swan, Hunter & Wigham Richardson's. The St. Peters Engine Works are still busy; and at Messrs. Parsons' turbine works the activity that has existed throughout the summer months shows no sign of abatement. At some of the less important marine engine works restrictions of night work are being carried into effect, showing clearly that the pressure of work has lessened. In the smaller engineering works that are chiefly engaged in the manufacture of auxiliary machinery, business has fallen off somewhat during November, and a difficulty in securing orders, even at unprecedentedly low prices, is said to exist. Notwithstanding the somewhat discouraging outlook in the shipbuilding and engineering industries, the steel and iron trades appear to be buoyant, and the great manufacturing establishments at Consett, Newburn, and Jarrow, are reported to be in full activity. Work in local iron-foundries, however, is visibly slackening, and many men connected with this branch of work are out of employment. The electrical engineering works of the district are, without exception, busy, and in the case of Messrs. J. H. Holmes & Co., shiplighting forms an important portion of the work in hand.

THE WEAR.

(*From our Own Correspondent.*)

Shipbuilding.—Messrs. Sir James Laing & Sons are reported to have booked an order from a colonial firm for a passenger and cargo steamer of large size, which is to be fitted up in a superior style, and to be equipped with machinery capable of propelling her at a comparatively high rate of speed. All the berths are now filled with vessels in various stages, all of which are of large size, and both the firm's graving docks are occupied with vessels under repair. A large steamer for the frozen meat trade was launched on the 16th inst., and is now being fitted out in the river. The s.s. *Cyclops*, which is being equipped as a floating workshop to the order of the Admiralty, is well advanced towards completion, and will probably be ready for delivery by midsummer next year. Among other portions of this vessel's remarkable equipment is a properly arranged iron-foundry, and several punching and shearing machines, with lathes and other paraphernalia, never before, perhaps, seen aboard a sea-going vessel.

Messrs. Doxford are reported to have received an order from Dutch owners for two "turrets" of large size, and have just launched one for the "Hansa" Company, of Bremen. This, we believe, is the first turret steamer supplied to the latter Company. Messrs. Short Bros. are said to have received an order for a large steamer from Greek owners, and Messrs. Osborn, Graham & Co. are also understood to have secured further work. Messrs. Pickersgill have entered upon the scheme of extension referred to some time ago, and are expected to have all completed in six or eight months from now. Messrs. Priestman have a fair amount of work in progress, but at Messrs. Robert Thompson & Sons' there are one or two berths vacant. It is rumoured, however, that the latter firm have succeeded in obtaining orders for one or two vessels, but we cannot vouch for the accuracy of this

The Sunderland Shipbuilding Company launched a finely designed steamer for Hall, owners, early in the month, and have another vessel nearly ready for launching. The firm, who were the first to use pneumatic riveting on the Wear some eighteen or twenty years ago, have within the present year extended the application of the pnuematic system, and are now successfully using it for caulking and drilling, as well as for riveting. Messrs. Bartram & Sons have two large vessels in the framing and plating stages respectively, and are said to have other work in reserve.

Messrs. S. P. Austin & Sons are still very busy on new work, and are carrying out a pretty extensive repair to the locally owned steamer *Wensleydale*. Messrs. John Crown & Sons, of the Strand Yard, have received orders for four or five vessels of medium size, two of the orders being from Sir C. Furness. It is stated that Messrs. J. L. Thompson & Sons, of the North Sands Yard, will very soon make a commencement with the building of new premises for ship and engine repairing on a site acquired by them at the

South Dock, in the vicinity of the Wear Commissioners' No. 2 graving dock.

Engineering.—Messrs. John Dickinson & Son's establishment (the Palmer's Hill Works) is still busy, as may be noted by the continuance of the night shift. The electrical department at the Sunderland Forge and Engineering Works is kept actively going, but the forge department is scarcely so busy as it was in the summer months.

New premises are being erected in Strand-street, Monkwearmouth, in which Messrs. H. D. Davie & Co., of the Borough-road, Sunderland, intend carrying on the business of millwrights and general engineers.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

THE total exports of textile machinery from the country for October were valued at £657,150, as against £583,883 for October, 1905, and £449,118 for October, 1904. The total for the ten months of the year is £5,467,880, an increase of nearly a million sterling on the first ten months of 1905. British India and the Straits Settlements have taken the largest quantities.

The arrivals of cotton from American and Egyptian ports have been much heavier so far this year than last year. The total number of bales landed up to date approaches 100,000.

The imports of timber for October at Manchester Docks exceeded the consumption, and stocks have been largely increased. Leading descriptions have declined in value. From January 1st to October 31st, the totals were as follow:—Hewn pitch pine, 18,000 cubic ft.; sawn pitch pine 780,000; pitch pine planks, 62,000; Quebec board pine, 242,000; birch logs, 88,000; birch planks, 170,000; spruce deals (standards), 47,780; pine deals, 6,630; Baltic deals, 16,640; Baltic flooring, 11,870; Galatz whitewood, 7,360; oak, 38,000.

Mr. W. H. Hunter, in delivering the inaugural address as President of the Manchester Association of Engineers, commented at length in a very thoughtful, prognostic strain on the future wants of man as he increases on the earth and said the construction of the Panama Canal was child's play compared with the work which must be undertaken in order that the best might be made of the earth's surface. Means of communication and transportation, by which all parts of the globe shall be connected together even more closely and more directly than some parts are connected now, shall be provided. Manual labour must be superseded by mechanical efforts, directed by human hands and minds; animal traction must give place to mechanical traction. Horses were grain eaters, and horses must disappear. (They would not be worth their food.) Whatever happened, engineers must rule the world. The results of radio-activity, and the phenomena connected with it, to the engineers of the future no man could predict, but it was possible that at no distant date the engineering world would be startled by the revelation of a discovery relating to motive power of which they could at present have little, if any, conception.

The iron trade in the County Palatine is in a very flourishing condition. Prices are higher than at any previous period during the past two or three years. This is due in a great measure to the extraordinary and continued demand for pig iron and hematites for the United States and the European Continent. The home trade, however, is no small factor in the situation, for what with fifty or sixty new cotton mills and weaving sheds, either completed or in course of construction, there is a great demand for textile and other machinery. A great export trade in machinery and iron work of all kinds is also being done. Quotations: Scotch pig iron, Eglinton and Dalmellington, 67s. 6d. per ton, delivered Manchester Docks; 2s. 3d. less per ton if delivered at Heysham or Fleetwood; and 1s. less if landed at Preston; Glengarnock, 68s.; Gartsherrie, 70s. ditto. Hematites, both East and West Coast, 70s. 6d. f.o.b.; Middlesbrough iron, 67s.; Derbyshire, 62s.; Staffordshire, 62s.; Lancashire, 64s.; Lincolnshire, 60s. 6d.; ditto foundry, 58s. 6d.; and ditto forge, 57s. 6d., delivered. Manufactured iron and steel firm, but with little alteration in quotations since our last monthly report, viz., steel bars, £7 5s. to £7 10s.; angles, £6 15s.; tees, £7 2s. 6d.; flats, channels, and joists, £7; iron bars, £7 5s.; steel boiler plates, £8 12s.; steel sheets, £8 10s.; steel hoops, £8 2s. 6d.; billets £5 15s.; steel ship plates, £7 to £7 5s.

The coal trade, like that of iron, is prosperous. There is a heavy demand in all sections—house coal, steam coal, gas coal, and coal for shipping. The trade is also benefiting by the removal of the coal tax. The operative miners are pressing for an increase of 5 per cent. in wages, and are seeking to secure the raising of the minimum rate of wages from 35 per cent. to 40 per cent. above the minimum basis fixed in 1888. They also desire a reconstruction of the Coal Conciliation Board when the present Board comes to an end on January 1st next. These questions have been brought before the existing Coal Conciliation Board, but the consideration was adjourned until an early date in the present month. Quotations for coal at the pits on the Manchester Coal Exchange are as follow: Best house coal, 13s. 6d. to 14s. 6d.; secondary, 12s. 6d. to 13s. 6d.; common, 9s. to 10s.; burgy, 7s. 6d. to 8s. 6d.; best slack, 6s. 9d. to 7s. 6d.; medium, 6s. 6d. to 7s.; common, 5s. 9d. to 6s. 6d.; shipping coal, 9s. 6d. to 10s. 6d. There is also a good demand for furnace coke.

During the first ten months of the present year the quantity of grain housed in the elevator and landed at the storage warehouse at Salford Docks amounted to 287,000 tons, or about 55,000 tons in excess of last year's total for the corresponding period. It is expected that the quantity of Indian wheat imported from Karachi direct to Manchester will this season equal that of last year, viz., 45,000 tons.

Mr. I. K. Bythell, the Chairman of the Manchester Ship Canal Co., calculates that next year the traffic receipts of the waterway will reach the sum of £160,000, and that for the following year as much as £210,000 may be reached. "It is never wise to prophesy," said Lord Beaconsfield, "unless you know." Mr. Bythell does not know, of course, but he judges, rather than prophecies, by past records, what the future will be. If Mr. Bythell's calculations should prove correct, the prospect for the Manchester ratepayers is of a satisfactory character. Except as a form of investment, through the sinking fund, the Ship Canal rate may be dispensed in the next municipal year, and in 1908 even the sinking fund may be paid out by the interest received. Half a century, however, will have to pass away before the sinking fund has done its work, but if all goes on well with the Canal a further generation of Manchester ratepayers, for whom to-day the present ratepayers are providing—but not intentionally—will receive interest on £6,000,000 as a free gift, and will have the advantages of a fine waterway to the sea, and a well-equipped port.

The perpetual motor designed by Sir W. H. Bailey, of the Albion Works, Salford, and recently erected at the mouth of the Thames, is believed to be able to be utilised for driving the rotary flashlights of lighthouses. It records the actual tide fluctuations on a huge diagram for thirty days. It also provides a perpetual clock regulated by the rise and fall of the tide. The varying depths of the tides are indicated on a dial. The winding mechanism is performed by the tide, and although the fluctuating value of tides and the period between the highest and lowest point have in the past prevented the utilisation of tides for the general purposes of a motor, this invention secures a perfectly regular motion, actuated by an irregular one. Each time the float, which dips into the water, is moved up and down, it actuates a pawl, and this in turn winds a weight of half a cwt., utterly independent of the float itself. The weight under this action becomes a reserve storage battery of power, and it is claimed by Sir William that, were the earth to stop suddenly, the recorder would continue for eight days telling time and depth.

THE THAMES.

(From our Own Correspondent.)

THE position of the important problem of the constitution of a new authority for the control of the river is that various bodies with any connection whatever with the matter have been asked by the President of the Board of Trade to formulate their views. The department not only considered the interests of the Thames Conservancy, but also the Waterside Manufacturers' Association, who

claim to represent the consumers of large quantities of the raw materials brought into the port, and they say that the purchase of the docks is undesirable, and dues should not be imposed on goods as well as on ships. As we have already remarked, the deputation from the Conservancy endeavoured to show that the dock companies should be left in possession of their warehouses, and only the dock entrances and waterways acquired. At the same time, the Conservancy are dredging the river, from the Nore to Gravesend, so as to give 30 ft. of water at low tide, and these operations will take three years, and it is sought in some quarters to postpone Parliamentary action till this work is finished. The City Corporation seems to favour much the same opinion, and advised a stay of action because no definite course is clear at present from any quarter. Meanwhile, the London Chamber of Commerce appears not to be very unanimous on the matter, but they have expressed their opinion that the docks are so behind the times that they are not worth purchase, and if such were completed would be a burden on the new authority. The financial question is evidently an important one, and probably that on which the matter will turn. The problem remains, therefore, a knotty one; and besides the vast interests of the public great attention will probably be paid to whatever steps are taken in the matter, as we had the word of the Government that it intended to introduce a Bill next session, but at the last moment the matter has been shelved. The dock companies do not intend, however, to let the question remain a dead letter, and they come forward with yet another proposed Bill. It is much on the lines of that they brought forward two years ago, and works on the recommendations of the Royal Commission on the subject. It would authorise the increase of the Conservancy from thirty-eight to forty-five members, and to appoint additional ones, and empower that body to raise £5,000,000 for dredging and deepening the river, and acquiring land and works. Dock dues would be fixed at 1s. a ton, while import goods would pay dues, such revenue being divided between the dock companies and the Conservancy, according to whether the goods were discharged in the docks or on the river. Barges under 100 tons would pay 3s. 6d. on entering the docks, and 5s. in the case of greater tonnage, receiving in return assistance in docking and undocking. The London and India Docks undertake, within six years, to make the Albert Dock extension, and to spend on that and other works £6,000,000. The Board of Trade may compel a dock to make improvements as long as the regular payment of dividends is not jeopardised, the northern companies to be fixed at 4 per cent. and the Surrey Commercial at 6 per cent. In this and other ways we need not enter into here, the companies propose to put themselves under the Board of Trade, and to co-operate with the Thames Conservancy, and thus they propose to solve the problem which looms so large at the present time. A great deal might be said in favour of this last scheme, and it will be observed there are not the financial difficulties attending it that there are with the more ambitious plans.

While all the above is progressing to maturity the ocean wharf project, lower down the river, comes to the front again. A syndicate for this purpose has, we believe, been registered, and it is for the purpose of building a big wharf which shall be accessible to ships at all states of the tide. The site chosen is in the neighbourhood of Greenhithe, where it is said not less than 30ft. depth is available at all times. The proposed wharf is to be 3,600 ft. long, parallel with the shore, and permitting fleets of barges to pass between the shore and the inner side of the wharf. With ships moored on the outside of the wharf goods would be transferred to the barges and so distributed, and it is claimed that this wharf is outside the area of the London County Council, and has been licensed in perpetuity, enabling goods to be handled cheaply and quickly. For transhipment the scheme seems important, the low cost and speed with which such transhipment could be effected being certainly in its favour. Shipowners are said to be in favour of it, as well, in certain cases, they might be.

The Marine Board revolt, as it is termed, remains much in the same position as before. The whole of the local marine boards would be placed in the control of officials in London, and shipowners complain in all the principal ports that the advantages of local supervision of crews and their payments would be neutralised. In the result, an advisory committee is proposed to be set up which, while giving the Board of Trade the control of the matter, the nominees are to be from the local marine boards, shipowners, certificated officers, engineers, seamen and firemen. The reason for the change adduced is that the Board of Trade finds the salaries of the local marine boards, whereas these were originally provided by the shipowners themselves. Meanwhile Mr. Havelock Wilson has put forward a motion to undo the shipping regulations of half-a-century ago, and this, if carried, would upset all the present arrangements and abolish the local marine boards.

Echoes of the London County Council's steamboat policy come up when a bill of £4.222 has to be paid for repairs to the boats, and it is said a still further sum is due for the same purpose. An action, too, has been brought by a waterman, who claims to have been thrown out of his boat by the speed of one of the Council's steamers, and damages were obtained.

The City Corporation have been refused by the Government permission to use Custom House Quay for the purpose of facilitating traffic to and from Billingsgate Market, and one of the members suggested a jetty should be built in the river opposite the market in order to increase the accommodation. Though two millions of money has been spent on improvements in this neighbourhood the Corporation have evidently difficulties to face which are by no means solved.

Dover still makes a great show with her port possibilities. The Channel ferry and tunnel are both uppermost at the present time, and the Harbour Bill is unexpectedly meeting with vicissitudes in committee, and these may have an important bearing on further developments here.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—The shipbuilding trade is in a bad way in this district. The launch of the Russian cruiser *Rurik*, on November 17th, left the yard of Vickers, Sons, & Maxim practically bare. The only vessel in course of construction is a Brazilian battleship, and as some alterations in her design have been determined on, the work on her has been practically stopped. It is understood this vessel has to be some 20 ft. to 30 ft. longer than she was first designed, and this, of course, renders it necessary not only to alter her other dimensions, but her engine power as well. There are, of course, several submarines for the British Admiralty in course of construction, but the heavy work for which the Barrow yard is particularly adapted is wanting. Some especially important orders have been in negotiation for some time, and any day may bring to Barrow some work which will give back life to the heavy shipbuilding department. In the meantime the horse is starving, and the black squad have little or nothing to do. Messrs. Vickers, in anticipation of orders which have not yet crystallised, have allowed smaller orders to pass them, and in the end there is reason to believe this policy will justify itself. The firm is still at work in extending their yard, and in putting down the best and most up-to-date machinery and appliances for the rapid and economical output of work, and the yard is now not only one of the biggest in the country, but it has been equipped regardless of expense, and it will sooner or later demand a big share of the orders which are in the market from time to time. The big 150-ton electric crane which has for some time past been in course of erection on the side of Vickers' new fitting-up wharf on the south-east of the Buccleuch Dock has been completed, and is now ready for testing. The firm has now two big electric cranes in the Devonshire and another in the Buccleuch Dock, and in addition to these, they have a 100-ton hydraulic crane, all of which can be used in lifting weights on to ships; and, in the case of the two 150-ton cranes, the jibs are able to lift weights from the shore on to the outer of two vessels lying alongside each other. It will thus be seen that the firm are laying themselves out to do a very large business, and special circumstances which are well understood are only keeping the yard bare of work for the moment.

Vickers, Sons, & Maxim is one of the firms which has been invited by the Admiralty to tender for one of the three *Dreadnoughts* in this year's programme, and it is hoped the order will come to Barrow, where work is so scarce at present.

The Peruvian cruiser, the *Almirante Grau*, has been completed and is away to the Pacific Coast; her sister ship, the *Coronel Bolognesi*, will soon be ready for her trials, and it is anticipated she will prove herself an even better vessel than the *Almirante Grau*, as the builders profited by their experience in the trials of the latter cruiser.

In the engineering shops a very large programme of work is proceeding, and it is expected that the activity shown will be maintained for at any rate two or three years to

come. The marine shops are now very busy, and in the gun-mounting department there is a scene of briskness which is not likely to give way to a quieter state of things for some time to come. Boiler makers are busy, and iron-founders are kept well employed. There is not, however, much briskness in the steel-casting trade, but a much better prospect is afforded, and it is expected before long that steel foundries will have as much work as they can do.

West Cumberland.—A very steady tone characterises the shipbuilding industry at Workington and Maryport, and as one order is disposed of another goes on the stocks. In fact, shipbuilders at these places seem to have solved the difficult question of how to be always busy, even in times when the trade of other parts of the country is not particularly brisk. To some extent this is because they have a class of business which is not very keenly competed for.

Shipbuilding Material.—The demand for shipbuilding material has improved during the month, and makers are not only better employed, but they have a better outlook. Ship plates which have been at £7 per ton net cash are now five shillings higher on account of the advance in pig iron.

Hematites.—A very marked improvement has taken place in the hematite iron trade, both as regards demand and prices. Makers are well sold forward, and are quoting 73s. per ton net f.o.b., and warrant iron is at 72s. 4d. net cash sellers. Stocks have increased, and now stand at 73,506 tons.

Shipping.—The total exports of iron and steel this year has reached 745,710 tons, an increase of 4,369 tons on the corresponding period of last year.

BELFAST.

(*From our Own Correspondent.*)

THE output of tonnage from the Belfast yards is now nearly complete, and, so far as can be seen at present, the figures will be something like those for 1905.

On November 15th Messrs. Harland & Wolff launched a steel screw steamer named *Sierra Leone*, which they have built to the order of the African Steamship Company. The new steamer is a sister ship of the *Aburi*, launched by them for the same owners in October. The principal dimensions are: Length, 370 ft.; beam, 49 ft.; and gross tonnage 4,000 tons. These two vessels have been specially designed and constructed for the Company's West Coast trade, having large deadweight carrying capacity on light draft. No further launches will take place from the Queen's Island this year, but there are several large vessels in an advanced stage of construction on the stocks, which will be put in the water early in 1907. Two days after the launch of the *Sierra Leone*, the new twin-screw steamer *Rohilla*, which Messrs. Harland & Wolff have built for the British India Company, left the fitting-out wharf for trial in the Lough. The *Rohilla* is a vessel of 7,800 gross tonnage, and she has accommodation for about eight hundred passengers. Provision has also been made for utilising the vessel for the purpose of carrying troops. After a successful trial the steamer left for London in command of Captain Smith. Messrs. Harland & Wolff are at present carrying out considerable extensions in their engine works, and in the same department they have just completed the erection of a fine suite of time offices.

Messrs. Workman, Clark & Co. have two more vessels of large dimensions to put in the water before their output for 1906 will be completed. On the 8th of November they had a successful trial of the new steamer *Howth Head*, constructed by them for the Ulster Steamship Company Ltd., Belfast. Full particulars of this vessel—which is the seventh built by this firm for the same owners—appeared in the last issue of the MARINE ENGINEER. On November 20th they launched a fine new screw steamer named *City of London* for the Ellerman Lines Ltd. (City Line Branch). She is a vessel of 8,000 gross tonnage, and is 507 ft. long. Luxurious accommodation will be provided for a large number of passengers. The machinery consists of a set of quadruple-expansion engines supplied with steam by four boilers working at 215 lb. pressure, under Howden's forced draught system. These engines, it may be stated, are the largest yet constructed by Messrs. Workman, Clark & Co. In the way of repairs this firm has had the Holt liner *Lxion* in hands for some time past. She is at present in Graving Dock and will shortly be ready for sea again. They also have the Houlder liner *Beacon Grange* for extensive damage repairs rendered necessary by the fire which took place recently on this vessel.

Messrs. MacColl & Co. have lately executed damage repairs to the Glasgow steamers *Belford* and *Kintail*.

Millfield Foundry, which was until recently occupied by Messrs. James Moore & Sons Ltd, has been acquired by Messrs. Hamilton & Brown.

At the last meeting of the Belfast Harbour Commissioners, the Chairman (Right Hon. Sir Daniel Dixon, Bart., D.L., M.P.) stated that the Commissioners had inspected the Alexandra Graving Dock and found that the progress made in connection with the repairs was as satisfactory as could be expected, and that the contractors hoped to have the dock ready for re-opening early in August. It is some kind of satisfaction to learn even an approximate date of the completion of this work; but, even though the time mentioned be adhered to, in the intervening period much repair work will be lost to the port.

Several people have from time to time been "nibbling" at the Foyle Shipyard, Londonderry, but at last there seems to be every prospect of the shipbuilding trade being revived in that port. In September, the Harbour Commissioners, who are the landlords of the yard, granted an option of a lease to a firm in the North of England, who proposed to form a company with a capital of £50,000, but they were not able to complete the business within the period of the option. Negotiations are, however, again being carried on with the same firm, and the option has been extended until February 1st. It is now stated that work will probably be started after Christmas, a substantial portion of the necessary capital having been already subscribed, and the promoters being confident that the remainder will be forthcoming immediately. In anticipation of the yard being re-opened orders for the construction of two large steamers have been secured, and negotiations are in progress with regard to the building of two other vessels.

There has been a sudden cessation of work in connection with the fitting-out of the Leyland liner *Servian* at the Queen's Island. The vessel has changed hands, and her new owners intend having extensive alterations carried out. Work will be resumed as soon as the plans for these alterations have been completed.

Messrs. Workman, Clark & Co. have contracted to build a steamer of between 6,000 and 7,000 tons for the Tyser Line, London.

Five-figure Mathematical Tables. By A. Du Pré Denning. London: Longmans, Green & Co. 1906.

THIS work is said to be for school and laboratory purposes, and is an endeavour to condense tables required in making calculations, and also to provide, in a small compass, at the end, a compilation of general information that may be required by scientists. If it is possible to provide, for instance, logarithmic tables in a few pages, which ordinarily take a volume by itself, even though there be some additional reckoning necessary, perhaps this will meet a want. There have been attempts in this direction before, and while, perhaps, the average man will prefer still to obtain logarithms for prime numbers without any further trouble, this rule may not apply in all cases. There are, for example, persons who use adding machines, while the ordinary reckoner goes on in the old way. This does not detract from the value of the machine in any way; and here is a system by which, with a few pages of tables and a little explanation, as an introduction, we have what is intended as a simplifier and time-saver.

The logarithmic table here takes one page only, the same for anti-logarithms. We have tested the system. It is simple enough, and appears thoroughly workable. In two other single-page tables we find the logarithms and anti-logarithms of reciprocals of numbers from 1 to 10, and, by the use of these, we may find the value of fractional expressions. By trigonometrical functions of angles, from 0 deg. to 90 deg., any calculations, involving sines, cosines, and derivatives, are rendered simpler. Tables of squares and cubes enable us to perform the operations of involution and evolution readily, without going through the work itself, according to usual rules. This will indicate sufficiently the nature of the task the author sets himself, without any further description, we think, from us.

JUNIOR ENGINEERS.

III.*

By W. W. A.

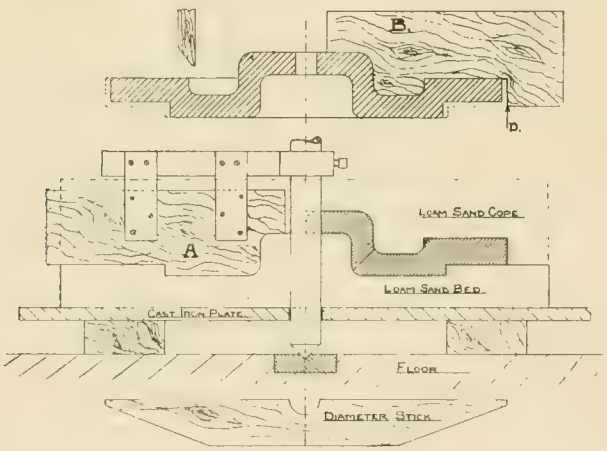
These columns are mainly intended for Apprentices, and we shall be glad to answer any Queries or explain any points that are not perfectly clear, and to recommend Books on the various subjects under discussion.

PATTERN MAKING (*continued*).

THE skeleton pattern effects a considerable saving in material, as even where white pine is employed for the rougher parts of the main body, the expense of a large solid pattern is no small item in the cost of a job. This method also obviates the necessity for core-boxes, and reduces transport and storage charges, hence it is frequently adopted for heavy uniform work such as columns, condensers, and cast pipes.

The pattern is built up as framework, the outside forming the mould, and the inside the core, the thickness of wood being that of the required metal. Where this thickness does not admit of half-checking the boards, butt joints are employed, with wood or hoop-iron straps screwed on, the impression left by these being filled in by the moulder, or stopped off, as it is termed. The smaller branches, feet, flanges, and facings are fixed on solid, and core-boxes made as required.

For circular work, of regular form, however, even the skeleton is cumbersome, and the loam pattern is consequently employed. This embraces a large section of marine work, pistons, piston-valves, pipes, propellers, cylinder covers, and similar parts, being almost invariably "swept up" by the moulder, the pattern-maker supplying the sweeps and striking boards. A cylinder cover affords one of the best instances of this method of moulding, and the accompanying sketches will illustrate the *modus operandi*. The system is the same throughout this class of work, differing only in details, and where bosses, ribs, or facings break the continuity of the surface these are supplied as solid patterns and fitted in by the moulder, a drawing of the job on a board giving their exact positions.



A cast-iron plate is supported off the foundry floor by means of blocks, and through the central hole in this plate a spindle of from 1½ in. to 3 in. diameter is passed, resting in a footstep let into the floor and rigidly held at the upper end by a bracket attached to the wall or a post, so that it is truly vertical and free to revolve on its own axis.

To this spindle a socket guide bar is clamped by a set screw, this holding the sweep boards in position as shown at A, in this manner the sweeps can be revolved round with the spindle, the spirit level being applied to adjust A to the horizontal plane.

A loam bed is first spread to a depth of a few inches over the bottom plate. This loam is a mixture of clay and clean, sharp sand. The board A is then swept round this heap, and forms the bed to the contour of the under side of the cover, to the shape of which, including the machining and contraction allowances shown to dotted lines, the board A is cut.

To give a clean sweep, the broad edges are bevelled, so as to leave a cutting edge about ⅛ in. broad.

The surface of this loam is then brushed over with a mixture of coal dust or powdered charcoal and clay water, termed blackwash, and thoroughly dried.

To prevent the weight of metal breaking down the mould the whole is bricked round, the cope, or upper part, being either brickwork or the top of a moulding box of cast-iron.

The board A is now replaced by B, which is cut to the upper side of the cover, with a projecting part which rests on the face of the bed, thus giving the thickness of the metal. This board is attached to the spindle in the same manner as the previous one, and to fix the diameter of the cover, the diameter stick is fitted on the spindle, the board B butted against its end at D and screwed up to the guide bar. Another layer of loam is now spread over the dry surface of the bed to the requisite thickness, and the board B revolved so as to form the upper face of the cover, thus completing the pattern as shown in half darkly sectioned.

This surface is also blackwashed and dried as before, the spindle being removed and the hole filled in.

The cope is then placed over the pattern, filled up with loam, and rammed down so that it will take the impression. When this has dried sufficiently, the cope is lifted off, and the pattern removed, the blackwash preventing loam from the mould adhering to it.

A hole is shown in the cover to take an escape valve, but unless this is more than 1½ in. in diameter, no core is put in. If larger a core is set into the two parts of the mould, as also any ribs or facings that may be necessary, these latter being wood patterns removed from their impression before finally closing the mould.

Gates for pouring in the metal, and vent holes for the escape of air and gases, having been formed in cope loam, the mould is removed, to be dealt with by the founder. This system of sweeping out the moulds is specially adapted to the making of large cylindrical cores; loam is plastered on to a revolving spindle till the full diameter is reached, when the core is formed to the contour of the board being used.

For cores which are not truly cylindrical, a skeleton outline is constructed to guide the sweeps. Thus in the core for a turbine cylinder, a soleplate supports the end ribs, and the board rests upon, and is guided by, these, the outline of the sweep being that of the inside of the casing stepped up to form the increasing diameters of the expansions. The core is in halves, of semi-cylindrical form, and as these are alike one box does for both. For the mould proper, however, it is usual to make a pattern for each half of the casing, the lower half having the foundations and steam inlets, the upper part carrying the exhaust branch, and having various other differences according to the type and construction of the cylinders.

*For articles I. and II. see last two issues.

Westland.—On October 27th the launch of this vessel took place at Rotterdam. She is being built by Messrs. Rijkee & Co., to the order of Messrs. The Shipping and Coal Company, of Rotterdam, and is 230 ft. long, 34 ft. 4 in. broad, with a depth of hold of 17 ft. 1 in. The vessel is to have Lloyd's highest class, and is of self-trimming type, with four strong winches and a large Cockran donkey-boiler. She will have steam-steering gear, electric light throughout, and is intended to be thoroughly up-to-date for the coal trade, particular attention being paid to the necessity for quickly loading and discharging, while specially powerful pumps will be fitted for dealing promptly with the large supply of water ballast for which there is capacity. A deadweight of 1,700 tons is to be carried on a draught of 13 ft., under which conditions a speed of 10 knots is anticipated. The machinery is being constructed by Messrs. Wiltons' Engineering and Slipway Company, under the inspection of the owners' superintending engineers, Messrs. Flannery & Gregson, of Rotterdam, London, and Liverpool. The engines are triple-expansion, with cylinders of 17½ in., 28 in., and 45 in. diameter, and a stroke of 36 in., supplied by steam from two large boilers, 11 ft. 10 in. long, by 10 ft. 3 in. diameter, and having a pressure of 180 lb. There are to be a wench exhaust, tank feed, filter, heater, and all modern accessories.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Helredale.—On October 29th Messrs. R. Craggs & Sons Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer, 358 ft. 6 in. long, 50 ft. 8 in. beam, 25 ft. 6 in. depth (moulded). This vessel is being built under special survey to take the highest class under Lloyds' three-deck rule with one deck laid, having poop, long bridge, and forecastle. Accommodation is provided for captain, officers, engineers, and apprentices, in spacious deckhouses on bridge, and the crew in the forecastle. Cellular double bottom is fitted throughout for water ballast also after peak, the total amount being about 1,200 tons. Six powerful steam winches are provided of the most approved type, driven from a specially large multi-tubular donkey boiler. Steam steering gear is supplied, and improved quick warping steam windlass is fitted forward. The arrangements for handling the ship and cargo are most complete in every respect. The machinery will be fitted by Messrs. Blair & Co. Ltd., of Stockton-on-Tees, and will have cylinders 25 in., 41 in., 67 in., by 45 in. stroke, steam being supplied by two large single-ended boilers working at 180 lb. to the sq. in. The vessel has been built to the order of Messrs. Thomas Turnbull & Son, of Whitby, and on leaving the ways was named *Helredale*. The specifications have been supervised and the construction of the hull and machinery has been carried out under the superintendence of the owner's resident surveyor, Mr. T. C. Alder.

Corunna. On October 31st the large steamer *Corunna* was launched at Hartlepool by Messrs. Furness, Whitby & Co. Ltd., which vessel has been built to the order of Messrs. The Agincourt Steamship Company (Messrs. Lloyd & Co., managers), of London. The length of the vessel exceeds 350 ft., built to 100 A1 with Lloyds, and will be fitted out as a first-class modern cargo boat. She has large hatches, clear holds, allowing of bulky storage, six powerful steam winches, large donkey boiler, and special attention has been paid to all derrick and lifting gear. Cellular double bottom is fitted all fore and aft her water ballast, the after peak being also available as a tank. The main engines will be supplied by Messrs. Richardson, Westgarth & Co. Ltd., Hartlepool, with cylinders 24 in., 39 in. 66 in., by 45-in. stroke, with boilers 16 ft. by 10 ft. 9 in. long, and 180 lb. pressure. The christening ceremony was gracefully performed by Miss Mabel Vick, of Higham, West Hartlepool.

Ellaline.—On October 31st there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields, a steel screw steamer, which has been built to the order of Messrs. Hutchins Brothers, Cardiff, and named the *Ellaline*. The vessel is of the following dimensions: Length overall, 358 ft. 6 in.; breadth, 49 ft. 6 in.; depth (moulded), 27 ft. 11 in. She is of the improved single-deck type, to Lloyds' highest class, and designed to carry 6,700 tons on a moderate draught, having a cellular double bottom all fore and aft, and fitted with poop, long bridge, and topgallant forecastle. The machinery and boilers are also constructed by Messrs. John Readhead & Sons, the engines being of triple-expansion type, having cylinders 25 in., 42 in., 68 in., and 45-in. stroke, steam being supplied by two large steel boilers working at a pressure of 180 lb. per square inch.

Camphill.—On November 1st Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, viz.: Length, 371 ft. 9 in.; breadth (extreme), 50 ft.; depth, 28 ft. 4 in. The vessel is built to the highest class at Lloyds, and is on the spar deck rule, and fitted with 8 ft. 'tween decks. She will have poop, bridge, and topgallant forecastle, the framing being of bulb angle. The saloon and cabins for the captain and officers and engineers will be fitted up in iron houses on the bridge deck. She will be fitted with water ballast on the cellular principle, also in the after-peak. The vessel has a quick, direct steam windlass, stockless anchors, steam-steering gear amidships, with powerful screw gear aft, and is fitted with eight specially large steam winches, all working at 100 lb. steam pressure. The vessel is fitted with double derricks, and all her appliances for loading and discharging are very complete. Triple-expansion engines will be supplied by Messrs. Blair & Co., of Stockton-on-Tees, having cylinders 26 in., 42½ in., 69½ in., by 45-in. stroke, steam being supplied by three single-ended boilers, each 14 ft. 6 in. by 10 ft. 6 in., with a working pressure of 180 lb., and fitted with evaporator, &c. The vessel has been built to the order of Messrs. Macbeth & Co., Ltd., of Glasgow. As the vessel left the ways, she was gracefully christened *Camphill* by Mrs. Leonard Ropner, of Eaglescliffe, R.S.O.

John O. Scott.—On November 1st there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Ltd., at Bill Quay, Newcastle-on-Tyne, a new steel screw steamer which has been built by them to the order of Messrs. John O. Scott & Co., of Newcastle. The vessel is of the long-raised quarter-deck type, with bridge and topgallant forecastle, and has specially large hatches for self trimming. The saloon, captain's accommodation, &c., is arranged under the bridge deck amidships, the officers and engineers being berthed in sidehouses at after end of engine casing, and the crew in the topgallant forecastle. Water ballast is provided in the cellular double bottom and fore and after peak tanks. The vessel will be fitted with all the usual deck machinery for facilitating the rapid loading and discharging of cargo. The machinery has been constructed and will be fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend, and is of the latest improved triple-expansion type, supplied with steam by a large steel multitubular boiler. Both the ship and the engines have been built to the requirements and under the special survey of Lloyds for their highest classification, and have also been superintended during construction by Mr. Norman Burnett, consulting engineer, of Newcastle. A large number of ladies and gentlemen were present to witness the launch, which was in every way successful, and as the vessel left the ways she was gracefully christened *John O. Scott* by Miss May Skeffington Scott, daughter of Mr. John O. Scott, of Riding Mill.

Lindenfels.—On November 1st Messrs. Swan, Hunter & Wigham Richardson, Ltd., launched from their Neptune Yard, the ss. *Lindenfels*, a steel screw steamer, about 436 ft. long by 55 ft. 3 in. extreme breadth, which has been built for the Deutsche Dampfschiff-fahrts Gesellschaft "Hansa," of Bremen, for their rapidly increasing trade. The vessel, which will carry about 8,500 tons deadweight, is fitted with four crank quadruple-expansion engines on the Yarrow, Schlick & Tweedy system, supplied with steam by three large single-ended boilers. When completed, the equipment of the vessel will be of the most up to-date type. Mr. Ahlers, the Director-General of the "Hansa" Co. was present at the launch, and Miss Ahlers, his daughter, gracefully performed the christening ceremony as the vessel left the ways.

Kattenturm.—On November 2nd there was launched from the yard of Messrs. William Doxford & Sons, Ltd., Sunderland, the ss. *Kattenturm*, built to the order of the Hansa Co., of Bremen, for their Eastern service. She is specially designed turret steamer, with several innovations, making her specially adaptable for the Eastern trade. The vessel is fitted by the builders with triple-expansion engines, indicating 2,500 H.P., and giving her a speed of 11 knots. The boilers are fitted with Howden's forced draught. The vessel is of exceptional large capacity and small tonnages. She has been built under the special survey of the British Corporation, Glasgow, and also under the direct superintendence of the owners' representatives. Amongst the visitors attending the launch was Director Ahlers, of the Hansa Line, and the christening ceremony was performed by his daughter.

Bombay.—On November 3rd there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 120 ft. by 22 ft. by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Messrs. The Grant & Baker Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways, she was gracefully christened *Bombay* by Mrs. J. R. Sturdy, of Hull, wife of Mr. J. R. Sturdy, who is surveying the building of this vessel on the owners' behalf, after which the company adjourned to the builders' offices, where breakfast was served, and the customary toasts given and responded to.

Myton.—On November 3rd there was launched from the yard of Earle's Shipbuilding and Engineering Company, Ltd., Hull, the *Myton*, a handsomely modelled steam trawler, built to the order of the City Steam Fishing Company, Ltd.,

Hull. Her dimensions are 135 ft. between perpendiculars, by 22 ft. 4 in. (moulded) by 13 ft. 4 in. (moulded). She has been built under Lloyds' survey, and is intended for the Iceland trade. She is fitted with a whaleback, and specially constructed to encounter heavy weather, and to provide a shelter for deck hands forward. The machinery will consist of a set of triple-expansion engines, with an extra large boiler. The whole is of the most up-to-date design, and strongly proportioned, everything which should lessen the cost of upkeep and increase the efficiency of the vessel under ordinary working conditions being provided for. The naming ceremony was performed by Miss Elsie M. Phillipson, and amongst others present were Messrs. J. A. Laverack, W. J. Stephenson, J. Watson, and F. Somerscales (Earle's Company).

Lebu.—On November 5th there was launched from the yard of Earle's Shipbuilding and Engineering Co., Ltd., Hull, the ss. *Lebu*, which has been built to the order of the Compania Sud Americana de Vapores. This is a sister ship to the *Teno*, which was launched from the same yard, and has sailed for Valparaiso. The dimensions of the vessel are: Length, 340 ft.; breadth (extreme), 40 ft.; depth (moulded), 24 ft. She has been built of steel to Lloyds' 100 A1 class, and is fitted for carrying a large quantity of water ballast in cellular double-bottom and aft peak tank. The vessel will carry about 3,950 tons deadweight, and have a large capacity for cargo. She has a poop, bridge, and topgallant forecastle, two pole masts of steel, each fitted with derricks, and all necessary cargo gear, including a 30-ton steel derrick stepped on deck for heavy lifts. There are six powerful steam silent winches of Earle's Company's special make, two geared steam winches, and two steam coaling winches by Messrs. Clark, Chapman & Co., steam windlass by Messrs. Emerson, Walker & Thompson, and steam-steering gear by Messrs. Davis & Co., fitted under the bridge. The hatches are arranged at the sides of the vessel in pairs, with chafing bulkheads, in 'tween decks and holds, to allow of a rapid discharge of cargo into lighters. For bunkering the vessel a system of cranes and shoots, operated from coaling winches on the bridge, has been adopted. A commodious house has been provided at the fore end of the bridge for the captain's room and chart-room. The saloon is placed at the fore end, under the bridge, and the officers and engineers are also berthed on this deck in rooms at sides of casings, the petty officers, seamen, and firemen being accommodated in the forecastle. The machinery consists of a set of triple-expansion engines, with cylinders 23 in., 37 in., and 61 in. diameter, by 42-in. stroke, working at a pressure of 170 lb. per square inch, and supplied with steam by large single-ended cylindrical boilers. Economy in coal consumption and in upkeep of engines and boilers has been carefully considered in the design of the machinery, all working parts and bearing surfaces being extra large. The naming ceremony was performed by Miss Kate Dewsbury (Leeds), and amongst those present were Mr. Thos. Dewsbury (the English representative of the Compania Sud Americana), Miss Ada Dewsbury, Mr. Brown, Mr. W. F. Harris, and Mr. F. Somerscales, and other officials of Earle's Company.

O. A. Knudsen.—On November 15th Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled steel screw steamer of the following dimensions, viz.: 352 ft. by 51 ft. by 25 ft. 1½ in. depth (moulded); single-deck type, and built to the highest class in Lloyds, under special survey, with poop, bridge, and topgallant forecastle; water ballast in double bottom fore and aft, and in peaks; is rigged as a fore and aft schooner, and equipped with seven double-powered steam winches, with additional derrick posts, and derricks to facilitate rapid loading and discharging, steam-steering gear, steam windlass of the quick-warping type, screw gear aft, and all modern improvements. She is equipped with shifting boards throughout in the holds for carrying grain cargoes. The accommodation is provided in large central deckhouse for captain, saloon, &c., the officers and engineers being in houses alongside engine casing, and the crew in the forecastle. Her engines have been constructed by Messrs. John Dickinson & Sons, Ltd., Sunderland, the cylinders being 24½ in., 40 in., 66 in., by 45-in., with two large steel boilers working at 180 lb. pressure. The vessel has been built for Mr. Knut Knutsen, O.A.S., of Haugesund, under the superintendence of Enginieur Dahl, Captain Reinertsen, and Captain Larsen, and as she left the ways she was gracefully christened the *O. A. Knudsen* by Mrs. Captain Reinertsen, of Bergen.

Utgard.—On November 15th an important launch took place from the yard of the Northumberland Shipbuilding Company, Ltd., the vessel being a finely moulded steamer built to the order of Messrs. The Midgard Deutsche Seeverkehrs Aktiengesellschaft, of Bremen, it being the fourth vessel built by the Northumberland Shipbuilding Co. for this company, who have another vessel at present building for the same owners. The vessel is 372 ft. overall by 48 ft. beam (extreme), by 30 ft. 10 in. depth (moulded), and has been built under special survey to the highest class at Lloyds' spar-deck rule, with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation—which is very ample—being all placed in steel houses on the bridge deck. The 'tween decks are lofty, and so arranged that cattle, troops, or emigrants may be carried if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes has been arranged for, consisting of nine steam winches, by Messrs. Clarke, Chapman & Co., Limited, Gateshead-on-Tyne, a large number of cargo derricks, steam-steering gear, by Messrs. Hastie & Co., Greenock, and steam windlass, by Messrs. Emerson, Walker & Thompson Bros. She is, of course, fitted with the usual water-ballast arrangements for light passages. The vessel is designed to carry 7,300 tons deadweight, on a draft of 25 ft. 0½ in., and steam about 10 knots loaded at sea. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co. Limited, Sunderland, the engines having cylinders 25 in., 41 in. and 69 in. by 48-in. stroke. Three large steel boilers 14 ft. by 10 ft. 9in., 180 lb. working pressure.

Guardiana.—On November 17th there was launched from the yard of Palmers' Shipbuilding and Iron Company, Limited, Jarrow, the steel screw steamer *Guardiana*, which has been built to the order of the British Maritime Trust, Limited. This vessel has been specially fitted up complete with refrigeration for frozen meat, and has been chartered for a term of years for the River Plate trade of the Anglo-Argentine Shipping Company, Limited (Messrs. Wincott, Cooper & Co., London managers). The dimensions of the vessel are as follows:—Length (between perpendiculars), 411 ft; breadth (extreme) 52 ft. 9 in.; depth (moulded) to upper deck, 32 ft. 6 in. The steamer has been built to take the highest class in the British Corporation Registry; is rigged as a two-masted fore and aft schooner; has complete steel upper and main decks, also shelter deck of steel, all fore and aft, sheathed with pitch pine; accommodation is provided amidships in deckhouses for captain, officers, and engineers, also for twelve first-class passengers, in a spacious saloon house.

Nora Niven.—On November 17th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 96 ft. by 20 ft. 6 in. by 11 ft. depth of hold. The vessel has been built to the order of Messrs. The Napier Fish Supply Company, of Napier, New Zealand, and will be fitted with powerful triple-expansion engines, by Messrs. The Great Central Co-operative Engineering and Ship Repairing Company, Limited, of Grimsby, and refrigerating and ice-making machinery by Messrs. The Linde British Refrigerating Company, Limited, of London. This is the only steam trawler which has been built for the New Zealand Fish Company, and is so constructed that, should she not be a success as a fishing venture, she can be easily turned into a small cargo vessel. As the vessel left the ways she was gracefully christened the *Nora Niven* by Miss Dorothy Alward, of Grimsby, granddaughter of Mr. G. Alward, of Grimsby, after which the company adjourned to the builders' offices, where breakfast was served, and the customary toasts given and responded to.

Picton Castle.—On November 17th there was successfully launched from the shipbuilding yeard of Mr. William Walker, Maryport, a finely modelled steam trawler of the following dimensions:—Length, 120 ft.; breadth, 22 ft.; depth (moulded), 12 ft. 6 in. The vessel is fitted with the latest improvements for fishing vessels, including a whaleback-forecastle and insulated fish-hold. She will be fitted with machinery by Messrs. McColl & Pollock, Sunderland. The vessel was named the *Picton Castle* by Miss Traill, of Maryport.

Duffield.—On November 20th, for the Northern Petroleum Tank Steamship Company, Limited, of which Messrs. Hunting & Son, Newcastle, are managers, Messrs. William

Doxford & Sons, Ltd., launched from their yard at Pallion, a large and well modelled turret steamer, built on the clear hold principle, which is one of the most recent features of turret construction. The dimensions are:—Length, 366 ft.; breadth, 50 ft.; depth (moulded), 26¼ ft. A deadweight of 6,600 tons will be carried on a draught of 21 ft. 9 in. The classification of the steamer is with the British Corporation Registry. The engines, with cylinders 25 in., 41 in., 66 in., and stroke 45 in., and the boilers are being supplied by Messrs. Doxford. As the vessel left the ways Miss Hunting gracefully named her the ss. *Duffield*.

President.—On November 20th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 128 ft. by 22 ft. by 11 ft. 9 in., depth of hold. The vessel has been built to the order of Messrs. The Anchor Steam Fishing Company, Limited, of Grimsby, and will be fitted with powerful triple-expansion engines, by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *President* by Mrs. W. S. Letten, of Grimsby, wife of Mr. W. S. Letten, J.P., managing director of the Company, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts were given and responded to.

Venture.—On November 20th a handsomely modelled steam trawler, the *Venture*, built to the order of Mr. G. Blashill, Hull, was launched from the yard of Earle's Shipbuilding and Engineering Company, Limited, Hull. The dimensions of the vessel are:—Length, 135 ft.; breadth, 22 ft. 4 in.; depth (moulded), 13 ft. 4 in. She has been built under Lloyds' survey for 100 A1 class, steel, and is intended for the Iceland trade. The vessel is fitted with a whaleback, specially constructed to encounter the heavy weather, and provide a shelter for deck hands forward. The machinery, which will consist of a set of triple-expansion engines, with an extra large boiler, is of the most up-to-date design, and strongly proportioned. Everything that can reduce the cost of keep-up and increase the efficiency of the vessel under ordinary working conditions has been provided. The naming ceremony was performed by Miss Winifred Blashill.

LAUNCHES—Scotch.

Valbanera.—On October 31st there was launched at Scotstown, by Messrs. Charles Connell & Co., Limited, a handsomely-modelled steel screw-steamer named *Valbanera*, of about 5,100 tons gross, for Spanish owners. The vessel has been specially built for their particular trade, and has accommodation for thirty-six first class and seventy second-class passengers, as well as for 1,000 emigrants. She has been built to Lloyd's 100 A1 class, with three decks, poop, bridge, topgallant forecastle, and boat decks. A complete installation of electric light is fitted throughout. The machinery will be supplied by Messrs. Dunsmuir & Jackson, Limited, Govan, and consists of triple-expansion engines with cylinders, 29 in., 46 in., 74 in., and 51 in. stroke, and two large double-ended boilers.

O-We-Ra.—On November 2nd the second of the fleet of large steam yachts now building, for American owners, by Ramage & Ferguson, Limited, of Leith, from designs by Messrs. Cox & King, of London, was launched, and on leaving the ways, was named *O We Ra*, by Mrs. John Ramage, in the unavoidable absence of Mrs. Stevens, wife of the owner. The *O-We-Ra* is a handsome craft of about 500 tons (yacht measurement), of the shade-deck type, originated by Messrs. Cox & King some fourteen years ago, and which has since become so popular, and is the fifteenth steam yacht built by Messrs. Ramage & Ferguson, Limited, from designs by that firm. She resembles in many respects the steam yacht *Wakiva*, built and designed by the same firm two or three years back for the late Mr. W. E. Cox, of Boston, U.S.A., but is rather longer on the lower water-line, and, like her, is fitted throughout with all the latest and most up-to-date appliances; and, needless to say, all appointments are of the usual luxurious character now looked for in first-class yachts. The machinery consists of triple-expansion engines, supplied with steam from a large boiler working at a high pressure.

Glenmorag.—On November 5th there was launched at Port Glasgow, by Messrs. A. Rodger & Co., for Messrs. Easton, Greig, & Co., Glasgow, a steamer of 6,100 tons carrying capacity, and of the following dimensions:—Length, 350 ft.; breadth, 48 ft.; depth, 29 ft. The machinery will be supplied by the builders. She was named the *Glenmorag* by Mrs. Greig.

Opawa.—On November 5th there was launched, at Dumbarton, by Messrs. William Denny & Brothers, the twin-screw steamer *Opawa*, for the New Zealand Shipping Co., Limited, London. Her principal dimensions are: Length, 460 ft.; breadth (moulded), 60 ft.; depth, 34 ft. Being primarily intended for the owners' extensive frozen meat trade from New Zealand, the entire fore end of the vessel is insulated in the holds and lower 'tween decks. The vessel has five hatchways, each fitted with powerful cargo gear, a feature of which is the great outreach over the ship's side which the derricks possess, thus enabling the cargo to be discharged direct into trucks without intermediate handling—an economy which has been much appreciated by the owners' clients. The propelling machinery consists of two sets of triple-expansion engines having cylinders 24½ in., 41¼ in., and 69 in., with a stroke of 4 ft. There are five cylindrical boilers, working under forced draught, each boiler having three suspension type furnaces. Owing to the great length of the voyages in the New Zealand trade, the vessel had a very complete outfit of spare gear, tools, and engine-room outfit. Mrs. King, wife of the managing director of the owners' company performed the naming ceremony. Messrs. Wailes, Dove & Co.'s bitumastic enamels were applied to the bunkers and tank tops in holds and engine-room.

Mercury.—On November 6th there was launched, from the Ayr Yard of the Ailsa Shipbuilding Co., Limited, of Troon and Ayr, the steel screw steamer *Mercury*, built to the order of Messrs. J. & P. Hutchison, Glasgow, for their trade with the Continent. The vessel's dimensions are:—179 ft. 6 in. length (between perpendiculars), by 27 ft. 9 in. breadth (moulded), by 13 ft. 3 in. depth (moulded). She will be fitted with triple-expansion engines, constructed by Messrs. Hutson & Sons, Limited, Kelvinhaugh, Glasgow. The vessel on leaving the ways was gracefully christened by Miss Hutchison, of Sauchie. Thereafter a large company assembled at the Hotel Dalblair, where luncheon was served.

Argyll.—On November 7th there was launched at Govan, by Messrs. Mackie & Thomson, the fish-carrying steamer *Argyll*, which they have built to the order of the Great Northern Steamship Fishing Company, Hull. The dimensions of the vessel are:—Length (between perpendiculars), 140 ft.; breadth (extreme), 22 ft. 3 in.; depth (moulded), 11 ft. 9 in.; and she has a net tonnage of 103. Triple-expansion engines of 13 in., 22 in., 37 in. diameter respectively by 27 in. stroke, and of 500 H.P., capable of giving a speed of 12 knots, will be supplied by Mr. W. V. V. Lidgerwood, Coatbridge. Mrs. Paterson, 4, Lorraine-gardens, Hillhead, performed the naming ceremony.

Phrygie.—On November 15th there was launched, at Dundee, by Messrs. Gourlay Brothers & Co., Limited, a steamer named *Phrygie*, for Messrs. N. Paquet & Co., Marseilles. The steamer is 370 ft. in length and of 3,800 tons, and is provided with accommodation for forty first and second class passengers.

Magdala.—On November 16th there was launched from the shipbuilding yard of Messrs. David & William Henderson & Co., Limited, Partick, the large steel screw cargo steamer *Magdala*, which they have constructed to the order of Messrs. Maclay & MacIntyre, of Glasgow. This latest addition to the fleet of vessels owned by this firm is a sister ship to the *Oceana*, recently completed by Messrs. Henderson, and is in length 415 ft. over all; breadth, 52 ft., with a depth of 29 ft. 8 in. (moulded); having a gross tonnage of about 4,850 tons, and will be classed in Lloyd's 100 A1 three-deck rule. She has been fitted with all the latest improvements, to ensure the rapid and safe working of the large cargo which she has been designed to carry, including nine powerful winches, and also large derricks fitted at the hatches. A complete installation of electric light has been fitted throughout the vessel. Steam steering-gear is fitted amidships. The saloon and officers' accommodation is on the fore end of bridge-deck, and a chart-room and wheel house have been built above this, with a bridge, which will give every facility to the officers in the navigation of the vessel. A set of triple-expansion engines will be supplied and fitted by the builders, having cylinders 26 in., 43 in., and 71 in. diameter, by 4 ft. stroke, also two large single-ended boilers, working at a pressure of 180 lb. The vessel was launched without any ceremony.

Inveran.—On November 16th there was launched at Port Glasgow a spar-decked steamer, built for Messrs. R. J. Rowat & Co., Glasgow. She was named *Inveran*, and is of 7,500 tons deadweight. Her dimensions are:—Length, 385 ft.; breadth 49 ft. 6 in; depth 29 ft.. The machinery will be supplied from Greenock.

Kentra.—On November 16th there was launched at Port Glasgow, by Messrs. William Hamilton & Company, Limited, the steel screw steamer *Kentra*, built to the order of Messrs. Japp & Kirby, Liverpool. The principal dimensions of the vessel are:—Length 413 ft., breadth 50 ft., depth (moulded) 29 ft. 10 in., gross tonnage about 4,750 tons, and is designed to carry about 7,800 tons. The steamer has been built under special survey to Lloyd's highest class, and is lighted throughout by electricity. The machinery will be fitted by Messrs. David Rowan & Co., Glasgow, and consists of triple-expansion engines, having cylinders 26 in., 44 in., 73 in.; two powerful boilers fitted with Howden's forced draught, &c. During construction the vessel has been under the supervision of Messrs. Bushell, Fletcher & King, consulting engineers and naval architects, Liverpool.

Frankdale.—On November 16th there was launched at Whiteinch by Messrs. Charles Connel & Co., Ltd., a steel screw steamer for the Palace Shipping Company, Ltd., of which Messrs. Macvicar, Marshall & Co. Liverpool, are managers. The dimensions of the vessel are:—Length 400 ft., breadth 52 ft. (moulded), depth 31 ft. 3 in. (moulded), with a gross tonnage of about 4,950 tons, and a deadweight carrying capacity of about 8,000 tons. She is built to Lloyd's highest class, and in excess of their requirements both in hull and outfit. The arrangements for loading and discharging cargo are of the most modern and approved type. The holds and 'tween decks are so arranged as to give a minimum of obstruction, being constructed on the girder principle, and a deep tank, which is available for either water ballast or cargo, is fitted abaft the engines, and in addition to the double bottom the peaks are also utilised for ballast purposes. The bridge space and poop are fitted with side-lights, and so can be utilised for cattle or transport of troops. The engines, intended to develop 2,300 H.P., are being supplied by Messrs. Dunsmuir & Jackson, Ltd, Govan. They are of the most approved triple-expansion type, and are supplied with steam for three large boilers fitted with Howden's system of forced draught. As the vessel left the ways she was named *Frankdale* by Mrs. Anthony R. Marshall, wife of one of the managers.

LAUNCH—Irish.

Sierra Leone.—On November 15th Messrs. Harland & Wolff launched the fine steel screw steamer *Sierra Leone*, for the African Steamship Company (managing agents, Messrs. Elder, Dempster & Co.), for their West Coast service. The vessel, which is a sister ship to the *Aburi*, recently launched by Harland & Wolff for the same company, is 370 ft. long, by 49 ft. beam, and about 4,000 tons gross, and has been built to class 100 A1 at Lloyds, under special survey. The *Sierra Leone* will have superior accommodation for first and second class passengers, with smoke-room and saloon; she will have a large deadweight carrying capacity on a light draught, and the arrangements for working the ship and cargo will be of the most complete kind, a special feature being the number of powerful derricks and winches at each hatch. The engines will be triple-expansion, and the vessel will have electric light throughout. The owners were represented at the launch by Mr. Campbell.

TRIAL TRIPS.

Bangarth.—On October 30th the ss. *Bangarth* (of which we gave particulars in our October issue, page 98), built by Sir Raylton Dixon & Co., Ltd., Cleveland Dockyards, Middlesbrough, and engined by Messrs. John Dickinson & Sons, Sunderland, to the order of Messrs. Rea Shipping Co., Ltd., Liverpool, left the Tees for her official trials, which passed off most successfully, and the vessel returned to Middlesbrough to load a cargo for Cardiff, where she will proceed under the command of Captain Armstrong.

Ariel.—On October 31st the new steel screw steamer *Ariel*, built by Messrs. Wood, Skinner & Co., Ltd., of Bill Quay-on-Tyne, to the order of Mr. L. B. Rafen, of Holestrand, Norway, left the Tyne for her official trial trip. The vessel, which has been built to Norwegian Veritas highest class, is of the single deck type, with a two-masted schooner, and is fitted with all the latest improvements to facilitate the loading and discharging of cargoes. The machinery, which has been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engineering Works, Wallsend-on-Tyne, consists of a set of their latest type of triple-expansion engines, having cylinders 19 in., 31 in., and 51 in., by 36-in. stroke, steam being supplied by two large steel boilers working at a pressure of 180 lb. per sq. in. Notwithstanding the very heavy wheather which prevailed during the trial run, the engines worked without the slightest hitch, and easily maintained a speed of 10 knots, which was considered most satisfactory by all concerned. Amongst those present were Mr. L. B. Rafen, owner, Mr. Skinner and Mr. Leslie Skinner, representing the shipbuilders, and Mr. Summers Hunter, representing the engine builders.

Blackfriargate.—On November 1st the ss. *Blackfriargate* (of which we gave particulars in our November issue, page 134), built by Messrs. Ropner & Son, Stockton-on-Tees, to the order of Messrs. Thomas Middleton & Son, of Hull, made her official trial trip on a run round to the Tyne, when she attained an average speed of about 11 knots per hour. She is fitted with triple-expansion engines by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, which worked very satisfactorily indeed. The vessel has been built under the superintendance of Mr. Walter A. Sage, M.I.N.A., of Hull. The trial trip passed off in every way very satisfactorily. Mr. J. R. Garthwaite was present on behalf of the builders.

Roberto Nunez.—On November 1st Messrs. Lobnitz & Co. took out for trial on the Clyde the steel screw tug *Roberto Nunez* (of which we gave particulars in our November issue, page 136), which has been built to the order of Messrs. Pearson & Son for the Tehuantepee National Railway Company. The vessel has been built under the supervision of Messrs. Flannery & Gren, of Liverpool, London, and Rotterdam. During the trial everything worked very smoothly, and the vessel averaged a speed of over 10½ knots.

Spider.—On November 1st the steam trawler *Spider*, just completed by Earle's Shipbuilding and Engineering Company, Limited, Hull, to the order of the British Steam Trawling Company, Limited, of Hull, was taken for her official trial trip. The visitors were taken on board at Victoria Pier, and the vessel then proceeded to the measured mile, Sunk Island, where full-speed trials were run. These proved highly satisfactory, and a mean speed of over 10¾ knots was obtained. Her seaworthy qualities were also tested. Throughout the whole trial the machinery worked in a very satisfactory manner, and the vessel, which is of the latest type, gave every satisfaction. The owners were represented by Messrs. J. H. Robins and J. Bell, and the builders by Messrs. J. A. Sturrock and J. L. Read.

Howth Head.—On November 8th the latest addition to the fleet of the Ulster Steamship Company (Messrs. G. Heyn & Sons, managers), the ss. *Howth Head* (of which we gave particulars in our November issue, page 137) steamed down the Belfast Lough for adjustment of compasses and speed trials. This steamer brings the total number of vessels owned by the Head Line up to sixteen, and seven of these have been built by Messrs. Workman, Clark & Co., Ltd., Belfast. After a successful cruise, the *Howth Head* proceeded to Port Talbot, where, we understand, she is to take part in the opening of new docks, afterwards taking in bunker coal prior to her departure for New Orleans, to take her place on the regular service of the Head Line steamers.

Dirphys.—On November 12th the handsome steel screw steamer *Dirphys* (of which we gave particulars in our November issue, page 135), built by Messrs. Wm. Gray & Co., Ltd., and engined from the Central Marine Engine Works of the builders, for Messrs. The Navigation à Vapeur Panhellenique, Athens, had her trial trip in Hartlepool Bay. After adjustment of compasses, a trial run was made with the vessel in ballast trim, when an average speed of 11 knots was obtained. The owners were represented by Captain Papaconstantinopulos, the shipbuilders by Captain J. E. Murrell, and the engine builders by Mr. Wm. Reynard. The vessel afterwards proceeded to Blyth, to load for Piraeus.

Titan. On November 13th the twin screw steamer *Titan*, built by Messrs. David & William Henderson & Co., Ltd., Meadowside Works, Partick, Glasgow, for the Ocean Steamship Co., Ltd., of Liverpool (Messrs. Alfred Holt & Co.), underwent a satisfactory trial trip on the Firth of Clyde. This vessel, which is of the following dimensions: length overall, 500 ft.; breadth (moulded), 58 ft.; depth (moulded), 42 ft. 6 in., with a gross tonnage of about 9,000 tons, is intended for the owners' Eastern trade, for which she has been specially designed; and, together with a sister ship, the *Cyclops*, previously completed by Messrs. Henderson, which recently left the Clyde on her maiden voyage, forms a departure from the ordinary type of cargo steamer, being quite unique in her arrangements. The holds are divided into seven large compartments, all of which are void of the usual pillars, and consequently are free from obstruction, the decks being amply supported by strong girders of a special construction, thus enabling cargo of the most bulky character being shipped. The customary masts and sails are dispensed with, and, in lieu thereof, are fitted four tall, powerful posts, which serve the double purpose of acting as derrick posts and hold ventilators. These posts are placed two abreast forward and aft, the forward ones being connected by a bridge for the use of the look-out. That ample attention has been given to the rapid handling of the heavy cargoes carried on such a large vessel is proved by the fact that, in addition to the four derrick posts already mentioned, there are twelve steel derrick posts distributed over the deck, with no less than thirty-one derricks connected to twenty-six powerful steam winches. Captain, officers, and engineers are berthed in steel deckhouses amidships, the rooms being of exceptional size and comfortably fitted up. Seamen's and firemen's quarters are aft. Accommodation is provided in forecastle and in upper 'tween decks aft for a large number of emigrants, for whom every necessary convenience has been fitted. A complete installation of electric light has been fitted throughout the vessel, including a powerful searchlight for use in the Suez Canal. The machinery, which has been supplied and fitted by the builders, consists of twin engines, each having cylinders 23 in., 38½ in., and 65 in. diameter, by 48-in. stroke, and three large boilers, worked on the owners' closed ash-pit system of forced draught, for a working pressure of 190 lb. The owners were represented by Mr. George Holt and their superintendents, Mr. Wortley and Mr. Berry, and everything worked smoothly and satisfactorily during the trials, when a mean speed of nearly 16 knots was maintained on a double run between the Cloch and Cumbrae lighthouses.

Denbigh Hall.—On November 15th the *Denbigh Hall* (of which we gave particulars in our November issue, page 137), the latest addition to the Hall Line—one of the various lines included in the Ellerman Lines, Ltd.—successfully ran her trials on the Firth of Clyde. The steamer is one of a large number of similar vessels built during the last few years to the order of Sir John Ellerman, Bart., many of which have been built by Messrs. Barclay, Curle & Co., Ltd., of Glasgow, but, being the latest, she naturally possesses many points of superiority which the experience gained on her earlier sisters has shown desirable, and she can be considered as being a favorable example of a high-class modern cargo-carrying liner. She carries the large deadweight of 8,300 tons on a moderate draught, with a low register tonnage, and, as no passengers are carried, no restrictions exist to prevent the arrangements for carrying, stowing, loading, and discharging cargo, being, as they are, the best that experience can suggest for her intended service to India. The machinery, constructed by the builders, consists of one set of triple-expansion engines, with boilers of ample power, fitted with Howden's forced draught, and designed for a speed on service of 11 knots. During the trials, which were successful from every point of view, the owners were represented by Mr. Alexander Dalrymple and Captain Foster, and the builders by Mr. Gilchrist, the chairman of Messrs. Barclay, Curle & Co., Ltd., of Whiteinch, and members of the staff.

Elloe.—On November 21st the large steamer *Elloe* (of which we gave particulars in our November issue, page 134), built by Messrs. Furness, Withy & Co., Ltd., Hartlepool, and owned by Messrs. Bennetts & Co., Grimsby, proceeded on her official trial trip in Hartlepool Bay, which proved in every way satisfactory, a speed of 12 knots being easily attained. The machinery ran most efficiently throughout, and has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool. The vessel afterwards proceeded to Barry, to load.

Kittiwake. On November 23rd the ss. *Kittiwake* (of which we gave particulars in our October issue, page 99) left the Tyne on the conclusion of a very successful trial trip. This steamer has been built by Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works, Newcastle-on-Tyne, to the order of the Cork SS. Co., Ltd. The engines and boilers have also been built at the Neptune Works, and on the trial trip worked to the entire satisfaction of all concerned, driving the vessel at a speed of nearly 13 knots per hour. The Cork SS. Co., Ltd., were represented on the trial trip by Captain Hore, of Liverpool, their marine superintendent, and by Mr. J. A. Flockhart, of Liverpool, their superintending engineer, under whose superintendence the vessel has been constructed.

Bloemfontein.—Lately the steamer *Bloemfontein*, which is the first of two vessels Messrs. Archibald Mcmillan & Son, Ltd., Dumbarton, are building for Messrs. Bucknall Bros., London, went down the Firth on her trial trip. The *Bloemfontein* is of dimensions 413 ft. by 50 ft. by 29 ft. 10 in., and her machinery is by Messrs. Dunsmuir & Jackson, Ltd., Govan. After the trial, which was in every way satisfactory, the steamer left for New York.

Messrs. David Joy & Cooper have recently fitted their cylinders on engines of the following steamships: The *Northbrook*, built by Messrs. John Brown & Co., Ltd.; the *Lord Nelson*, built by Messrs. Palmers; *Agamemnon*, built by Messrs. Armstrong; *No. 608,613*, of Messrs. Denny & Co; also two ships being built by Messrs. Cramp, of Philadelphia, for the Canadian Pacific Railway.

BOARD OF TRADE EXAMINATIONS.

Extra First Class.—October 27th, 1906.

Abbott, Norman	Ex 1C Liverpool.
Boultbee, Henry A. ...	Ex 1C Hull.
Hagen, Charles A....	Ex 1C North Shields.
Ireland, Thomas P. ...	Ex 1C Leith.
Kidd, William L.	Ex 1C North Shields.
Kyle, Alick R.	Ex 1C Hull.
Macnaughton, R. C. ...	Ex 1C Liverpool.
Marshall, Weir C.	Ex 1C North Shields.
Mayer, Thomas	Ex 1C North Shields.
Milner, William H. ...	Ex 1C North Shields.
Taylor, Walter D.	Ex 1C Bristol
Thomas, George A. ...	Ex 1C London.
Watson, Clement	Ex 1C London.

NOTE.—1C denotes First Class; 2C Second Class.

October 27th, 1906.

Allinson, G. P. .	1C	Sunderl'd
Anderson, D. J.	1C	Lon'derry
Anderson, James	1C	Greenock
Aplin, Albert E.	1C	London
Attard, Armando	1C	London
Baird, John J....	2C	Liverpool
Ball, Albert E....	2C	Liverpool
Barnett, A G....	1C	Aberdeen
Bateman, H. C..	2C	London
Bond, George B.	2C	Bristol
Brown, Leslie ...	1C	Sunderl'd
Campbell, P. G..	2C	Greenock
Dewar, William.	2C	Aberdeen
Finny, John B. .	2C	Sunderl'd
Fleming, George	1C	N.Shields
Gerner, Edward	2C	N. Shields
Heed, Charles W.	1C	Bristol
Harris, Sydney J.	2C	N.Shields
Henderson, R. G.	1C	Bristol
Holloway, J. B. .	1C	Greenock
Howard, H. J....	1C	Liverpool
Hunter, W. E....	2C	Hull
Inns, Wesley E..	1C	London
Lacy, Alfred ..	2C	Bristol
Lane, William R.	2C	N. Shields
Lindsay, A. ...	2C	Aberdeen
Macfarlane, T.H.	1C	Liverpool
Maddison, R. ...	2C	N.Shields
Mains, Thomas P.	1C	Aberdeen
M'Diarmid, C. E.	1C	N.Shields
Miller, John T. .	1C	N.Shields
Newbold, H. A .	1C	N.Shields
O'Niel. Charles .	1C	Aberdeen
Perrett, T. W....	2C	Bristol
Porter, Robert...	1C	N. Shields
Reed, Harry A. .	1C	Sunderl'd
Richardson, A. .	2C	Sunderl'd
Robertson, John	2C	N.Shields
Saunders, A. E .	1C	Bristol
Scarfe, John J. .	2C	N.Shields
Taylor, John ...	1C	Greenock
Thompson, R. ...	1C	Sunderl'd
Tunstall, W. ...	2C	Liverpool
Volk, E. P. ...	1C	N.Shields
Wilkinson, H. S.	1C	Sunderl'd
William, E. H. .	1C	Liverpool
Willson, G. A....	2C	Dover
Wilson, Andrew	1C	Liverpool
Woodhouse, O. R.	2C	N.Shields
Youngson, F. S..	1C	N.Shields

November 3rd.

Absalom, Robert	1C	Liverpool
Anderson, James	1C	Glasgow
Arnold, Wilfred.	2C	N.Shields
Arthur, John T..	2C	Cardiff
Blake, David B.	1C	Cardiff
Bowey, Norman	1C	N.Shields
Branagh, A. H....	1C	Belfast
Bremner, David	2C	London
Brown, John H.	1C	Liverpool
Butler, Richard .	2C	London
Cambridge, A....	1C	Cardiff
Cameron, A. G .	2C	N.Shields
Cochrane, J. W.	2C	Glasgow
Collings, B. A....	1C	London
Crothers, Robert	1C	Belfast
Davidson, F. E..	1C	Cardiff
Dixon, Thomas .	2C	N.Shields

Farmer, A. J. ... 1C Cardiff
Foley, John M. . 2C Cardiff
Fraser, Andrew . 1C Glasgow
Gillan, William. 2C N. Shields
Gray, Joseph ... 1C Leith
Gray, Thomas R. 1C Glasgow
Guttridge, E. G. 2C South'ton
Hannah, W. E. . 2C Liverpool
Harvey, John B. 1C London
Henderson, E. T. 1C Glasgow
Hunt, George G. 2C Leith
Jones, R. H. ... 1C Liverpool
Kaye, James ... 2C Glasgow
Lang, W. A. S. S. 1C Glasgow
Lawson, John ... 1C Liverpool
Lockhart, A. W. 1C Liverpool
Lockie, James M. 2C Leith
Macrae, William 2C N. Shields
Matthew, Thomas 2C Leith
M'Gregor, J. R. 2C Liverpool
M'Kendrick, J. . 2C Glasgow
M'Nicol, John ... 1C Glasgow
Matthew, Thomas 2C Leith
Mieur, William.. 1C Glasgow
Nickolls, J. S. H. 2C Cardiff
Paterson, Walter 1C Glasgow
Roberts, J. E. ... 2C Liverpool
Ronaldson, N. J. 2C Glasgow
Russell, Peter D. 1C London
Savings, Daniel . 2C South'ton
Scott, Horace A. 2C London
Shaw, Hector ... 2C Glasgow
Smart, William . 2C London
Smith, Charles A. 2C Cardiff
Spence, William 2C Glasgow
Taphouse, F. G. 1C London
Thomas, W. E. ... 2C Cardiff
Wills, Alfred A.. 1C Falmouth

November 10th.

Arscott, A. R. ... 1C London
Blacklock, A. J. R. 1C N. Shields
Clark, G. F. W.... 1C Liverpool
Curtis, H. A. ... 2C London
Dalgliesh, W. J. 2C Liverpool
Dickinson, J. M. 1C N. Shields
Everard, John S. 1C London
Fisher, James A. 2C N. Shields
Harbottle, E. A. 1C N. Shields
Holme, E. J. ... 1C Liverpool
Jones, W. I. ... 2C N. Shields
Povall, Henry ... 2C Liverpool
Rath, Otto E. ... 1C London
Rathjen, J. H.... 1C Liverpool
Roberts, A. C. ... 1C N. Shields
Skinner, John ... 1C Liverpool
Sowter, A. K. ... 2C London
Stobbs, Thomas 1C N. Shields
Taylor, Harry... 2C N. Shields
Thirlwell, W. E. 1C N. Shields
Warren, Harry 1C Liverpool
Williams, W. W. 1C Liverpool
Wraith, G. H. ... 1C N. Shields
Brown Robert ... 2C Greenock
Bushby, R. W.... 2C Liverpool
Currie, Colin ... 2C London
Dickenson, A. R. 1C Hull
Fanning, F. E .. 2C N. Shields
Harrison, John I. 2C Hull
Hendry, A. J. ... 2C Greenock
Hughes, John R. 1C Liverpool
Hoy, William I.. 1C N. Shields
Jewels, Jacob R. 2C N. Shields
Kendrick, Arthur 2C Hull
Kissack, G. J. ... 2C Liverpool
Leggott, T. G. ... 2C Hull
Little, James ... 2C N. Shields
Macfarlane, W... 1C London
Margetts, R. J 1C Liverpool
Mercer, John ... 2C Dublin
Mitchell, Robert. 2C N. Shields
Moir, Thomas ... 1C Greenock
Ranken, James... 2C Greenock
Roberts, Richard 1C Liverpool
Salter, Thomas . 1C London
Seal, George E... 2C London
Sims, R. W. ... 2C London
Spence, S. M'D.. 1C Greenock
Thomas, William 2C Barrow
Venables, A. K.. 2C Hull
Walker, E. D. ... 2C Hull
Watson, Ralph... 2C N. Shields
Will, Frank S. ... 2C Dundee

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from October 25th to November 23rd, 1906:—

Engineer Vice-Admiral.—Sir A. J. Durston, K.C.B., Engineer-in-Chief of the Fleet, has been placed on the Retired List in accordance with the provisions of her late Majesty's Order in Council of June 29th, 1900.

Engineer-Captains.—J. Fielder, to the *Tamar*, as Chief Engineer, Hong-Kong Yard, to date October 30th; W. Hines, to the *President*, for temporary service in connection with oil fuel, turbine's machinery, and water-tube boilers, to date November 3rd.

Engineer-Commanders.—C. W. Bolt, to the *Sirius*, to date November 23rd; J. U. Crowle, to the *Bedford*, to date November 3rd; W. A. J. Davies, to the *Assistance*, to date November 28th; J. E. D. Graham, (lent) to the *Victory*, for oil fuel course, to date November 6th; S. G. Haddock, to the *Gladiator*, to date November 1st; H. Hawkins, re-appointed to the *Orion* for Malta, Royal Naval Reserve, and to Assistant Engineer-Captain of Malta Reserve, undated; C. J. Huddy, to the *Glory*; G. W. Hudson, to the *Repulse*, on re-commissioning, to date November 27th; J. E. Johnson, to the *Irresistible*, on re-commissioning, to date November 27th; H. I. Knapman, to the *Adventure*, to date December 4th; W. H. Meadus, for mechanical and stokehold training of seaman, to date November 6th; G. W. Noll, to the *Queen*; T. H. Pounds to the *Cornwallis*; A. Rayner, to the *Acheron* for supervision of instruction of second-class stokers, to date October 27th; W. C. Stevens, to the *President*, as engineer's overseer at Messrs. Vickers Son & Maxim's works, to date November 16th; C. H. Steward, to the *Tamar*, for change of machinery of the *Wear* and for Fleet duties at Hong-Hong, to date November 15th; A. T. Stone, (lent) to the *Victory* for oil fuel course, to date November 6th; A. T. H. Stone, to the *Topaze* to date December 4th; E. Swinney to the *Pandora* to date October 31st; J. H. Watson (lent) to the *Victory*, for oil fuel course to date November 6th;

Engineer-Lieutenants.—A. E. Atkins, (lent) to the *Victory*, for oil fuel course, to date November 6th; C. Barker, to the *Bacchante*, undated; W. C. S. P. Bartwell, to the *Proserpine*, to date November 17th; H. Basson has been promoted to the rank of Engineer-Commander, with seniority of October 17th, and re-appointed to the *Flora*, to date October 17th; R. J. Block, to the *Pembroke*, for the *Afridi*, to date November 7th; A. G. Bremner, to the *Mercury* for submarines, to date November 14th; H. S. Briggs, to the *Vivid*, for the *Bonaventure*; S. Brown, to the *Bacchante*, to date November 15th, and to the *Leviathan*, undated; R. C. Cleave, to the *Vulcan*, for the *Desperate*, to date November 27th; E. Cole, to the *Leviathan*, undated; W. H. Crichton, to the *Pegasus*, on re-commissioning, undated; W. Dawson, to the *Assistance*, to date November 28th; D. E. Duke, to the *Topaze* to date December 4th; A. C. Hall, to the *Vindictive*, to date November 17th; H. W. Harris, to the *Terpsichore*, on re-commissioning, temporary, to date November 10th; J. H. C. Hearn to the *Prince George*, to date November 6th; J. B. Hewitt, to the *Blake*, for the *Sylvia*, to date November 3rd; H. G. T. Howes, to the *Forth*, for duty with submarines; T. B. Huddy, to the *King Edward VII.* for duty with Engineer-Captain of Atlantic Fleet in connection with use of oil fuel and bituminous coal, undated; H. W. Irish has been promoted to the rank of Engineer-Commander with seniority of November 1st and re-appointed to the *Spartiate*, to date November 1st; T. O. Jameson, to the *Victory*, to be detailed for the *Bonaventure*, to date November 6th; F. Jarvis has been placed on the Retired List to date November 10th; J. Legate to the *Hecla*, for the *Surly*; H. J. Loveridge, (lent) to the *Victory*, for oil fuel course, to date November 6th; H. J. Loveridge, to the *President*, temporary, to assist Engineer-Overseer at Messrs. Parsons, Wallsend-on-Tyre, to date November 20th; J. Maxwell, to the *Irresistible*, on re-commissioning, to date November 27th; R. C. Miller, re appointed to the *Orion*, for service with Engineer-Commander for charge of machinery and for Malta Royal Naval Reserve, on re-commission, undated; R. B. Morison, to the *President*, as Engineer-Overseer at Messrs. Denny Bros., Dumbarton, to date November 15th; W. F. Pepperell, re-appointed to the *Orion*, for charge of stores and care of workshops and machinery, on re-commission, undated; W. S. Reid, to the *Adventure*, to date December 4th; H. H. Ricketts, to the *Argyll*, to assist Engineer-Captain as oil fuel instructor; W. J. Steil, to the *Vulcan*, for the *Stag*, to date November 15th; E. F. St. John, re-appointed to the *Orion*, for supervision of boats, on re-commission, undated; A. C. Turnbull, to the *Bacchante* to date November 15th, and to the *Leviathan*, undated; A. Turner, to the *Bacchante*, undated; A. W. J. Turner to the *Irresistible*, on re-commissioning, to date November 27th; T. J. Wells, re-appointed to the *Orion*, for Malta Royal Naval Reserve and for the training of stokers, on re-commission, undated; H. J. A. White, to the *Pegasus*, on re-commissioning, undated; G. Wormald, to the *Sapphire* for the *Swale*.

Engineer Sub-Lieutenants.—R. O. L. Bond, to the *Irresistible*, on re-commissioning, to date November 27th; R. J. Brown, to the *Black Prince*, to date October 31st; H. L. Hammond, to the *Mars*, temporary, on completing, undated; G. Hick, to the *Mars*, temporary, on completing, undated; A. Knothe, to the *Vindictive*, to date November 17th; S. C. Whyham, to the *Bacchante*, undated.

Institute of Marine Engineers.—A Bohemian Concert has been arranged by the Hon. Secretary and Hon. Min. Secretary for Friday, December 7th, at Stratford, when the President, Lord Pirrie, will preside, and present the Denny Gold Medal to Mr. Robert McKenzie, and the prizes awarded for essays written by graduates on a visit to the late Engineering Exhibition at Olympia, gained under the *nommes de plume* of "Veritas" and "Vulcan," adjudicated by Sir William H. White.

The Marine Engineer

And Naval Architect.

LONDON, JANUARY 1, 1907.

IN the present issue appear the usual ship-building returns which we have so long presented to our readers in January. There are several points of interest in the year's out-put. The new Cunarders have been put in the water at Clydebank and on the Tyne, and thus the record for size in steamship has been notably advanced. At the same time, by the launch of the new White Star Liner *Adriatic* on the same day as the *Mauretania*, Belfast turns out the biggest ship which Ireland has yet produced. On the 1st December the Vulcan Company at Stetiin sent down the ways the *Kron Prinzessin Cecilie*, which it is expected will be the fastest ship flying the German flag and the largest vessel in the Nord-Deutscher Lloyd Fleet. But whilst size and speed have been conspicuous in the out-put of vessels for the mercantile Marine, the British Admiralty has made its advance in the power and size of fighting ships. On the day which saw the *Adriatic* and the *Mauretania* launched in Ireland and England respectively, the Clyde received the great armoured cruiser *Shannon*, whose launch had been somewhat delayed by the discovery of a flaw in one of her stern brackets. That day will therefore long hold the record as a launching date, since it probably saw something like seventy thousand tons added to the fleets of the world. But the addition of the *Dreadnought* to the battleship fleet of the Royal Navy is perhaps the most remarkable event of the year just closing, for 1906 not only saw the greatest battleship ever constructed launched, but actually sent to sea on her most successful trials. No doubt Portsmouth Dockyard spared no effort to press forward the work of constructing this ship. No doubt, too, a large mass of materials was assembled prior to the date on which her keel was formally laid. Yet, when all this is borne in mind, the feat is one of which the chief Royal Dockyard may well be proud, especially in view of the fact that the big ship contains so many novelties and new departures. The fact that her turbine engines have given such unmixed success and that her great armament is capable of being fired without injury to the fabric which supports it, has effected a revolution in the building of capital ships for our own and foreign navies. We ourselves are about to add three of her class to our fleet; the keel of one is already laid and preparations for the commencement of a second are well advanced. France is to construct six great ships of this character during the next few years, the United States propose to lay down a vessel of even greater displacement, whilst Germany, having placed an order for a vessel of this class, is bound to prepare her docks and canals to cope with its accommodation. The promise of 1907 is, therefore, towards the launching of a considerable number of big war vessels, in spite of the fact that our own Naval Dockyards seem doomed to a spell of comparative inactivity. In the yards which devote themselves most largely to the building of merchantmen it may be said that Belfast displays the greatest signs of future activity, it being perhaps somewhat more than a rumour that a large White Star ship is to be laid down on the slips vacated by the *Adriatic*.

SINCE its introduction, the internal Combustion Engine has been engaging the attention of many engineering firms. During the last few years especially, considerable advance has been made in its design for land work and more recently it has been applied to marine service with some success on launches and canal boats.

The developments and improvements made from time to time have been gradually bringing this class of engine within hailing distance of the marine engineer, who has thus been led to study it with a view to gauge its adaptability for larger ventures than have hitherto been included within its scope. That a good prospect of advance towards more powerful engines for coasting and sea-going steamers exists, is evidenced by the fact that Messrs. Thornycroft, in the South, Messrs. Beardmore in the North and a Syndicate on the North-east coast are working out the problem more or less experimentally.

A paper read before the Institute of Marine Engineers by Mr. Timpson, deals with this subject and refers specially to a type of engine being manufactured in the neighbourhood overlooked by the Calton Hill, thus adding another district where the oil engine is being developed for sea service.

In his paper, the author points out that the adoption of motors using oils of a low flash point has been gradually extending, in spite of the restrictions against them, owing to the risks of fire and explosions, —restrictions which in many quarters have been occasioning considerable criticism. Yet these have probably been instrumental in inciting the inventive faculty and stimulating improvements.

The paper goes on to say that from the experience gained and the growing demand for motors adapted for higher flash oils, many makers are now offering paraffin motors for marine work, chiefly for small powers. In the fishing industry, the oil motor ought to have a good field, and movements are being made to cover this. Mr. Timpson refers to an oil engine fitted with satisfactory results to a large boat for the fishing trade by a Leith firm. The engine is described as of the Central Valve type, having one valve on the head of each of the three cylinders, for admission of the charge and air valves with connections to the

cylinder and crank chambers, one object of which is to scavenge and clean out the foul gases before compressing the fresh charge.

To facilitate starting the main engine, a small engine to drive an air compressor is provided, the compressed air is used for an impulse to give the first move ; the exhaust from the smaller engine goes to heat up the large cylinders. The boat quoted has a reversible propeller, the pitch being altered to accommodate the desired speed through the water, with a governor to regulate the engine speed. This engine can also be made to reverse. It is stated that twin oil engines of the same type, of 360 H.P. are under construction for a trawler, while smaller sets have been made for the East, giving good results. A sailing barge for coastal traffic has been fitted with 60 H.P. engines, giving a speed of 9 knots. In view of the steady running of this engine, it is advocated for electric and other auxiliaries on board ships, on the ground that a saving in weight, in pipes and economy in fuel would be effected. It is pointed out that on account of possible accident to a ship, with flooding of the engine room, the electrical machinery should be kept on the upper platform to avoid an added horror of darkness. The oil motor could be placed without regard to steam pipe arrangement. The cost of running this engine is guaranteed not to exceed half a pint of fuel per H.P., and in practice is less, while the cost ceases when the engine stops—there are no charges for " banked fires." Another point claimed is that the engine may be adapted to use the oil which can be most readily obtained in the district for which it is intended, the flash point being known and the class of oil ; so also as to the temperature of the circulating water available.

It is stated that an examination for cleaning, about once a month is sufficient and is not a laborious job. Fouling of the cylinder may be caused by the use of unsuitable oils for lubrication or for fuel. A case is cited where the paraffin had been placed in a linseed oil cask, thus causing trouble. The cylinders are stated to be independent of one another and can be worked separately if desired to reduce the power. Further papers and discussions on oil engines will be of service and we look forward to such, meanwhile we commend the attention of marine engineers to the subject.

A curious regulation exists in some of the Docks, in connection with which the owner of goods is not allowed to take his property out of the premises of the company without a pass duly signed and countersigned, after no inconsiderable trouble, but one who is not the owner and has no right to the property he carries off can get out without a pass at all. A well-known chief engineer has pointed out that although he is unable to take out his second best suit of clothes from the ship to his lodgings without a pass, the one who purloined his best suit from his cabin required no pass, and naturally questions the wisdom of the regulation referred to, and asks should it not be reversed ?

THE SCREW PROPELLER.

VI.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

PRIOR to the competition between the *Alecto* and *Rattler*, there had been made a series of most interesting and instructive trials, with the object of ascertaining the best proportions of screw for this latter ship and to demonstrate the comparative merits of the propellers designed by rival inventors, of whom the most prominent were Francis Petitt Smith and Bennett Woodcroft. Smith's screw, generally called the *Common Screw*, was a portion of a true helix as cut off by parallel planes at right angles to the axis, and was generally from one quarter to one-eighth of the diameter in length. It was, therefore, of uniform pitch throughout its surface and would be now called a *true screw ;* Woodcroft's, on the other hand, while being generally of the same form and proportions as Smith's, was made with a pitch which increased gradually from the leading edge to the following, the idea being that there should be no sudden disturbance of the water along the leading edge, as it would be moving at the same speed as the ship and that the water was then to be set in motion gently and the motion gradually increased till it left the following edge. This was of course on a principle which is scientifically or theoretically accurate, but only true with certain limitations which will be dealt with later on.

Steinman's screw had two blades not unlike Griffith's first screw in shape, but carried on two arms so that there was a space between the blade and boss.

These trials would have been of greater benefit, at least to us now-a-days, if the men making them had not been too much fettered by the ideas then prevailing on the question of propeller efficiency. In those early days, in consequence, no doubt, of the original propeller of the Archimedes having been a long one, it was customary to consider diameter, pitch and length as the only necessary features for describing the screw. It seems not to have occurred to them till later that blade surface, as such, entered at all into their calculations, although, apparently, the percentage of slip was their sole criterion of efficiency. It is further unfortunate that in these particular trials the I.H.P. does not appear to have been taken, but that can now be estimated with a fair amount of approximation from the power developed on later trials and using the revolutions made as the variable. It is still more to be regretted that the dynamometer which was used in the trials against the *Alecto* was not employed on these trials, but it must be remembered that the prime object in carrying them out was to find the screw which produced the best speed. Whether by chance or by intention it is fortunate that the *Greyhound* should have been selected as the ship on which the late Dr. Froude should carry out his experiments for the purpose of determining the resistance of ships and

* For Articles I. to V. see last five issues.

the laws of comparison between ship and model, seeing that she was so very like the *Rattler* in dimensions and form; for we are thereby better able to appreciate the differences of performances of the screws on the several trials than were those engineers who carried them out.

Fig. 12 shows the curves of I.H. Power and dynamometer H.P. of H.M.S. *Rattler*, and the curves of I.H.P. and Resistance horse power of H.M.S. *Greyhound* reveals a huge discrepancy between the performances of the two ships, due in no small measure to the differences in diameter of the screws, which will be alluded to later. In examining Table X it will be observed that the experiments were with propellers practically all of one uniform pitch and of two diameters, but differing in the length and number of blades. Surface was not yet spoken of, but it has been calculated and shown on this table.

TABLE X.

TRIALS OF VARIOUS SCREW PROPELLERS ON H.M.S. RATTLER AT 12 FT. 5 INS. MEAN DRAUGHT. 1843 TO 1845.

	1 Smith's Common	2 Smith's Common	3 Smith's Common	4 Smith's Common	5 Smith's Common	6 Smith's Common	7 Smith's Common	8 Smith's Common	9 Smith's Common	10 Smith's Common	11 Woodcroft Inc. Pitch	12 Steinman Patent
Diam. of Screw .. ft.	9—0	9—0	9—0	9—0	9—0	9—0	10—0	10—0	10—0	10—0	9—0	10—0
Pitch do., do. .. ft.	11—0	11—0	11—0	11—0	11—0	11—0	11—0	11—0	11—0	11—0	11—0 11—55	11—5
Length do., do. .. ft.	4·25	3·0	2·25	1·71	1·60	1·17	3·0	2·0	1·5	1·25	1·7	—
No. of Blades	2	2	3	3	3	3	2	2	2	2	2	2
Surfaces do. sq. ft.	60·6	42·8	52·3	39·4	36·0	27·0	51·28	31·16	25·6	22·8	28·0	-
Revolutions	94·0	106·0	94·3	92·0	98·3	108·4	98·0	100·6	102·1	103·6	107·5	100·9
Speed of Ship	8·3	9·24	8·237	8·096	8·561	9·88	9·231	9·448	9·721	10·07	8·63	9·638
Slip per cent.	22·4	24·4	32·5	18·8	21·8	16·0	12·9	13·4	12·24	10·42	27·76	15·73
I.H.P. estimated ..	350	395	351	341	364	401	360	372	378	383	398	373
Ind. Thrst. do. .. lbs.	11,223	11,180	11,180	11,337	11,100	11,108	11,020	11,090	11,117	11,100	10,650	10,610
Propeller do., do. lbs.	6323	8060	6405	6080	6862	8530	8430	8896	9058	9435	8233	8944
Resistance of Ship ..	5720	7220	5645	5470	6130	8380	7200	7540	8050	8660	6236	7880
Restnce. Ship÷ Prop. Thst.	0·906	0·895	0·881	0·900	0·893	0·982	0·853	0·848	0·889	0·918	0·758	0·881
Prplr. Thst. ÷Ind. Thst	0·563	0·721	0·573	0·545	0·609	0·752	0·765	0·801	0·815	0·850	0·773	0·843
$Speed Ship^2 \div Prop. Thst$	0·0905	0·1060	0·1060	0·1077	0·1068	0·1170	0·1009	0·1022	0·1043	0·1074	0·0905	0·1039
$Speed^3 \div I.H.P.$	1·643	1·990	1·593	1·559	1·723	2·404	2·182	2·266	2·428	2·666	1·613	2·398

The original screw of the *Rattler* was 4·5 ft. long and the aperture or screw race was a long one and extended well forward of the stern post; the short propellers were sometimes in the middle of this aperture, and at others before the middle, which may help to explain the curious variations in the slip. The first experiments were with the small diameter screws, when the speed was increased from 8·3 knots with the two bladed with a surface of 60·6 sq. ft. to 9·88 knots with a three-bladed of only 27 sq. ft. The latter speed, however, was got with 108·4 revolutions of the screw as against 94 with the original screw, but the slip was only 16 per cent. as against 22·4 per cent. with the large surface. In fact, perhaps the most noticeable thing in these early trials is the slip varying with the surface instead of inversely to it, as is usually the case. That a screw of 9 ft. diameter and 42·8 sq. ft. of blade surface should have a slip of 24·4 per cent. when driven 106 revolutions with 395 H.P. is remarkable, and only susceptible of one explanation, *viz.*, that it was not supplied with sufficient water to "run full"; that it was partly churning the water and only partly projecting it aft. The same thing is noticeable with the three-bladed screws, for the one with 52·3 sq. ft. of surface ran with 32·5 per cent. of slip, while that with only 27 sq. ft. had only 16 per cent, or less than half that rate. It is, however, much more strange to find that the one (No. 5) with 36 sq. ft. ran with a slip of 21·8 per cent. With the 10 ft. diameter screws the slip is more reasonable, and follows the natural law of slip. Woodcroft's screw seems to have gone wrong in this trial, for afterwards his propellers gave good results and were severe competitors of Smith's. The Steinman screw appears to have been made with too small a surface, but its disposition was so good that the results of its trial compare very favourably with the other good ones.

Of the nine feet diameter screws No. 6 gave the highest speed, and its efficiency, as measured by dividing the speed cubed by the I.H.P. developed was 2·404, which is higher than the others show, but it is exceeded by Nos. 9 and 10 in this respect, and by No. 10 also in regard to speed, *viz.*, 10·07 against 9·88; consequently No. 10 was selected as the best screw for the ship. Now if No. 6 screw had been made with a pitch of about 12 ft. the decision would probably have been in its favour, for if looked into carefully, it is seen that all the 10 ft. screws caused a serious augmentation of resistance, while with No. 6 of the three-bladed

screws the thrust was very little more than the resistance of the ship if towed without a propeller; that is, of the total thrust over 98 per cent. was usefully employed whereas with propeller No. 10 which was deemed the most satisfactory one, less than 92 per cent. was so absorbed. the balance of 8 per cent. being required to overcome the augmented resistance due to the action of the screw. On the other hand, if the I.H.P. was as estimated in the table, it is evident the three-bladed screw with its 27 sq. ft. of surface required more horse power to turn it 108 revolutions than the two-bladed with only 22·8 sq. ft. at 103·6 revolutions in spite of the diameter being 10 as against 9; therefore, taking speed cubed divided by I.H.P. as the criterion, the

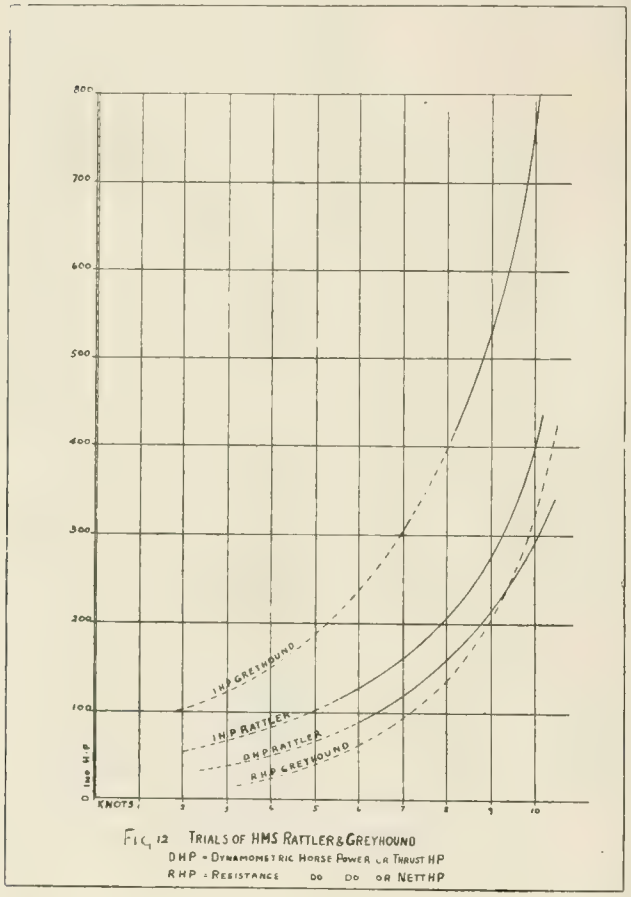


FIG 12 TRIALS OF HMS RATTLER & GREYHOUND
D.H.P. = DYNAMOMETRIC HORSE POWER OR THRUST H.P.
R.H.P. = RESISTANCE DO DO OR NETT H.P.

latter is to the former as 266 to 240. No doubt the broad tipped blades told heavily when there were three of them moving, as they were, at the rate of over 30 knots an hour through the water.

The thrust horse power of No. 6 screw is 258, and the net horse-power applied to turn the screw 320, which shows that 62 I.H.P. or 15·5 per cent. of the gross I.H.P. was required to overcome the friction and edge resistance of the screw, whereas with the two-bladed No. 10 the net power delivered to the screw was 307 and discharged by it 290, or only 17 I.H.P., or 4·4 per cent. to users. Now if No. 6 screw had had its leading corners cut away, as was afterwards done in other ships, and its pitch made 12 ft., it is pretty certain that a still better result would have followed. At the same time it must be admitted that if No. 10 screw had undergone a similar treatment its performance would have been improved. If to-day a similar ship were going to have engines of 400 I.H.P. at 100 revolutions, a screw 9 ft. diameter would be most suitable with a pitch of 11·75 to 12 ft., and if with three blades the surface would be about 24 sq. ft. Nevertheless the experiments evidently go far to prove that for small diameters at any rate the screw that will give the highest speed is one with two blades, and so long

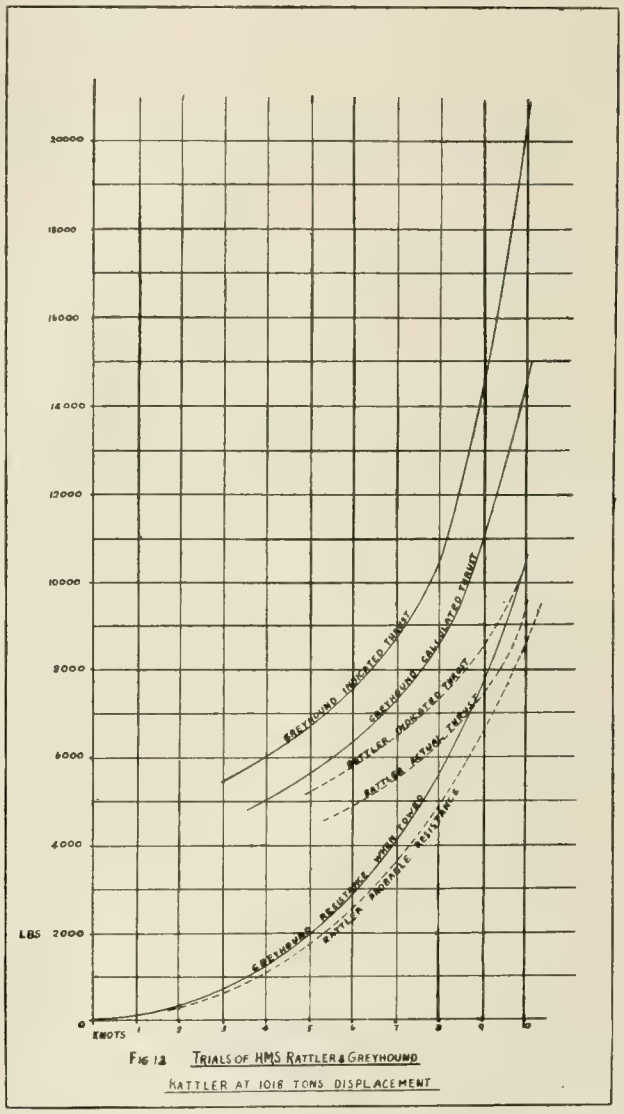


FIG 13 TRIALS OF HMS RATTLER & GREYHOUND
RATTLER AT 1018 TONS DISPLACEMENT

as it is well immersed it is, on the whole, satisfactory, but in larger sizes, and when the blade tips are so near the surface as to tend to make broken water, the propeller is out of balance and causes most unpleasant vibration and stresses the structure of the stern.

Unfortunately the engineers of that day not only decided in favour of two-bladed screws, but apparently attributed the success to the large diameter and consequently vessels of the same size and class as the *Rattler* came to be fitted with screws larger

than hers. H.M.S. *Greyhound* had a two-bladed one 12·33 ft. diameter, 15·5 ft. pitch with a blade surface of 52 sq. ft., driven by engines developing nearly double the power of the *Rattler's*, but only producing a speed of 10 knots against her 9·639. Fig. 12 shows the curve of power of the two ships and Table XI. full particulars of them, by which it is seen how dismal a failure the *Greyhound* was compared with the *Rattler*, in spite of the geared engines of this ship; and not only the *Greyhound* but the *Mutine* and scores of other ships following them with the big diameter of screw and broad tips. How many millions of money the big diameter theory has cost the British Empire is an interesting subject for enquiry by the statisticians. Fig. 13 is interesting as showing the curves of thrusts and resistances of the ships in question, those of the *Rattler* being for her trials when the draught was 12 ft. 3 in. mean and the displacement 1018 tons.

TABLE XI.

Comparison of Trial Trip Performances on load draught of H.M.S.'s Rattler and Greyhound.

	Rattler.	Greyhound.
Length, Perpendiculars ft.	176·5	172·5
Beam Extreme .. .. ft.	32·7	33·17
Draught of water, mean ft.	13·5	13·7
Displacement .. tons	1140	1157
Area immersed, mid section sq. ft.	348	330
Wetted Skin .. sq. ft.	7477	7540
Screw diamr. .. .. ft.	10·0	12·33
Do. Pitch .. .. .. ft.	11·0	15·50
Do. Surface of blades sq. ft.	22·8	52·4
Revolutions	104	80
Speed on measured mile knts.	9·639	10·038
Ind. Horse Power	437	786
$D_3^2 \times S^3 \div$ I.H.P.	224	142
Indicated Thrust .. .. lbs.	12130	20850
Calculated do. .. .. lbs.	10632	14410
Dynamometer do., towing lbs.	9650	10528
I.H.P. per 100 ft. W. Skin ab. 10 knts.	6·52	10·20
Calc. Thrust, do., do. .. lbs.	153	191
Date of Trial	1846	1865

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Nord Deutscher Lloyd.

The damages to the *Kaiser Wilhelm der Grosse* appear to have been even more serious than was at first imagined. The vessel, after temporary repairs, was taken to Bremen for a complete overhaul and, when thoroughly examined, it appeared that it would take not less than twenty-five days in dry dock to completely make good her injuries. What might have happened if the *Orinoco* had been built with the usual straight stem instead of the clipper bows, which the West India Royal Mail Company affect, may be left to the imagination. Certain it is that the installation of Stone-Lloyd water-tight-doors with which this vessel—in common with other modern mail steamers of the line is fitted would have been put to a good practical test. In this connection one cannot help regretting that the British Govermnent, which has during the present year devoted so much legislative attention to the British Mercantile Marine, did not see its way to include in one of its Merchant Shipping Acts a provision which might tend to induce shipowners to adopt this form of bows. They have on many occasions proved their value. I think I remember a case where one of the old Inman liners ran into an iceberg, and yet, owing to the overhang of her bows, confined her injuries to parts above the waterline. It would have been so easy to have introduced a provision that, in new vessels, a reduction of a small percentage from the nett tonnage should be allowed to ships so constructed. But now the opportunity is gone by, for it is much to be hoped that, after all that has taken place in 1906, the Mercantile Marine will be left severely alone for some years to come by Parliamentary reformers. Meanwhile the English Admiralty Court has been called upon to fix the liability for the collision, and has found it to rest solely with the Nord Deutscher Lloyd Liner. But detailed discussion of the suit must be held over till the next issue.

When the next passenger season is at its height, the Nord Deutscher Lloyd will be at last enabled to make a weekly sailing with an express steamer. For the *Kron Prinzessin Cecilie*, sister to the *Kaiser Wilhelm II.*, was launched by the Vulcan Company on the 1st December, and is to make her maiden sailing on the 6th August, 1907. It is unnecessary to go into details regarding her here, as anything that could be said would merely be a repetition of the account of the *Kaiser Wilhelm II.* But it is hoped that she will, as the result of the experience gleaned in the working of that ship, indicate not less than 45,000 i.h.p., and maintain a sea speed of some 23½ knots. It would seem unlikely that the Company would need to build further vessels of this class for several years, and thus it is improbable that a German turbine vessel will start, from the port of Bremen at all events, in opposition to the new Cunarders for some years to come. It is interesting to observe that at the banquet after the launch the general manager of the steamship Company mentioned the fact that during the connection between his line and the Vulcan Company there had been built at Stettin for the various services of the Company 192,000 tons of shipping with engines of an aggregate horse-power of 300,000. The amount paid for this fleet was put at 125,700,000 marks, say over 6¼ millions sterling. That would make the average cost per ton of the vessels something below £33 a ton. This indicates plainly enough, if indication were needed, that it is only for the better class of mail and passenger steamer that the Vulcan Company lays itself out.

Ships' Officers and Consuls.

In the November issue I mentioned the case of the steamship *Tredegar Hall*, and the refusal of the British Consul at Sulina to interfere for the protection of an engineer officer who had been assaulted by his subordinates for doing his duty to his employer. The matter has now been mentioned in the House of Commons by Mr. Summerbell, who was told that the reason for the Vice-Consul's refusal to take action was that he thought the matter one for the local authorities. Nothing has yet been allowed to transpire as to the alleged letter from the Board of Trade, in which it is said that new restrictions were placed on the action of Consular officers in these matters. But the subject is not to be allowed to drop, as the Hon. Ivor Guest, M.P., has taken it up, whilst the Cardiff Shipowners' Association has approached the Board of Trade with a request for a copy of the letter of instructions under which the Vice-Consul sheltered himself in his inaction.

The Morgan Combine

can hardly be said to be keeping its fleet up to date, though it has certainly discarded some of its more obsolete tonnage by parting with such vessels as the *Doric* and *Coptic* during the year which is just closing. Three vessels have been under construction for the line at Queen's Island, the *Adriatic*, the *Servian* and the *Scotian*. The former was delayed on the stocks—apparently to suit the convenience of the owners, whilst the other two vessels, though launched, lay incomplete for nearly a couple of years in the Musgrave Channel. Not long ago it was announced that they would soon be added to the effective strength of the fleet. But it would now appear that cash is more welcome to the management than ships, and so the pair of sisters have been transferred to the Hamburg-American line. The ultimate object for

which they have been bought is the Atlantic cargo trade, but the transport of German troops is a service for which they are to be adapted, and from their size they should prove excellent investments to their purchasers. But the sale of these ships seems to be an unanswerable indication that the time when reorganization and scaling down of capital will be necessary in the case of Mr. Morgan's Shipping Trust.

Treasure Hunting

seems to be still to the fore, in spite of the ill success of so many of the ventures. The latest announcement in this direction is the approaching voyage of the steamship *Alfred Nobel* to South Africa. She seems a suitable craft enough for the job, having twin screws and being of a handy size, some 380 tons gross register. She was built at Ardrossan in 1888. No less than thirty-eight wrecks are to be explored by her. The catalogue seems a fascinating one. Operations are to be commenced with an attempt to salve the copper and silver said to remain to the value of some £42,000 in the wreck of the Aberdeen liner *Thermopylae*, which was piled up some eight years ago at Green Point, Cape Colony. Then there are more doubtful stories running back over two hundred years which it is proposed to investigate. As regards the more recent wrecks there may be a prospect of a return to the explorers. But in the case of old disasters the records as to the valuables said to have been aboard the ill-fated ships are often unreliable, whilst in the days of unenterprising newspapers and sparsely populated coasts there may have been salvages of treasure of which no record is now available.

The Growth of Inter-Communication

between Europe and America is remarkable indeed. One fails perhaps, to realize the increase in the numbers of passengers crossing the herring-pond, as each new liner fills up her accommodation, vaster in most cases than that of any of her predecessors. But the statement of the growth of the mails, especially at Christmas time, is an excellent indication of the forward movement. Only a year or two ago one recorded with wonder that the Christmas transatlantic mails by such and such a steamship exceeded two thousand bags! In December, 1905, there were two or three consignments where the three thousand bags standard was past, But this year shows an immense increase even on these big figures. The *Celtic* of the White Star Line, leaving New York on the 12th December, first had the distinction of being the first steamer to carry upwards of four thousand sacks. But she only held that record for a single day, as the *Majestic* of the same line, leaving Queenstown on the 13th had over 4600 bags. What such consignments mean, not only in value, but as a means of bringing the sympathies of the two branches of the Anglo-Saxon race together is almost incredible. Surely the time has come when it would pay the respective Governments to reduce the postage between the States and Great Britain to a penny, as has already been done in the case of the Dominion of Canada.

Disasters.

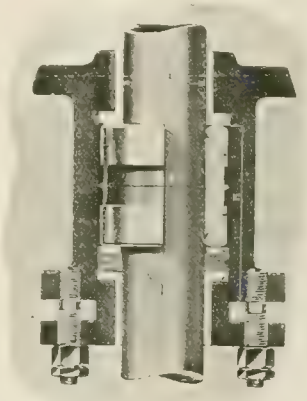
It is remarkable that two such disasters as those which occasioned the loss of the steamship *Nemea* and *Baron Huntly* in the North Atlantic, should have occurred within three days of one another. From the reports of the inquiries into these two abandonments, it would appear that the *Nemea*, which was homeward bound from St. John's, New Brunswick, with a cargo of timber, met with her fate through the bursting of her condenser-door, owing to the racing of her engines in bad weather. The Court was of opinion that everything that could be done to save the vessel was done, but that it was impossible to cope with the inrush of water, and the engines were flooded out so that the ship became unmanageable and fell into the trough of the sea. Unfortunately there was loss of life, a wave carrying seven persons overboard. Five of these, including the master, were rescued, but two—one of whom was the third engineer—were lost in spite of all efforts to save them. The Court held that after what had happened the master and crew were quite justified in taking advantage of the presence of the Johnston liner *Vedamore* and in abandoning the ship.

In the case of the *Baron Huntly*, however, the finding was to the effect that the abandonment was premature, and the theory of the engineers to the effect that the leakage was due to the bursting of the injection valve was held to be unsatisfactory. Moreover, the Court considered that the engine room staff did not make sufficient efforts to close the sea-connections or to make use of the ship's pumping power, and both master and chief engineer were adjudged to a three months' suspension of certificate. In this inquiry, as in that relating to the abandonment of the *Port Stephens* on the other side of the world, the members of the Court seem to have been too much disposed to take an armchair view of the situation in which those whose conduct they had to review found themselves, and did not, to my mind, make sufficient allowance for the difficulties under which a decision had to be reached. The *Port Stephens* was on a voyage from Dunedin to Newcastle, New South Wales, when she broke her shaft and lost her propeller under circumstances which made it admittedly impossible for those on board to restore her engine power to her. For five days she drifted in a direction which was taking her right out of the track of vessels into the solitudes of the Pacific. She was further short of provisions. To her under these circumstances appeared a sailing barque, the *Ravenscourt*, which was, of course, unable to render her assistance by towage, but whose master was willing to take the steamer's crew aboard. This offer was accepted and the *Port Stephens* was abandoned. The abandonment seems to have been justified by the event. For though vessels were immediately sent in search of the derelict, no trace of her was to be found. Yet the Court of Inquiry at Dunedin, whilst giving the master credit for the attempts he had made to effect repairs, held that he had been guilty of an error in judgment in leaving his ship, and condemned him to pay the costs of the inquiry. This decision, casting a slur, which many of those acquainted with the circumstances hold to be unmerited, upon the matser's reputation, has been the subject of a good deal of comment.

The latest disasters concern the Hamburg-American Line's extensive fleet. In one case a new acquisition, the large telegraph steamer *Anglia*, on her way to Queen's Island to be adapted for their services, has stranded in a bad position at the entrance to Steamford Lough. In the other, the tourist Steamer *Princessin Victoria Louise* has been totally lost at Kingston, Jamaica. The latter accident was followed by the dramatic suicide of the master.

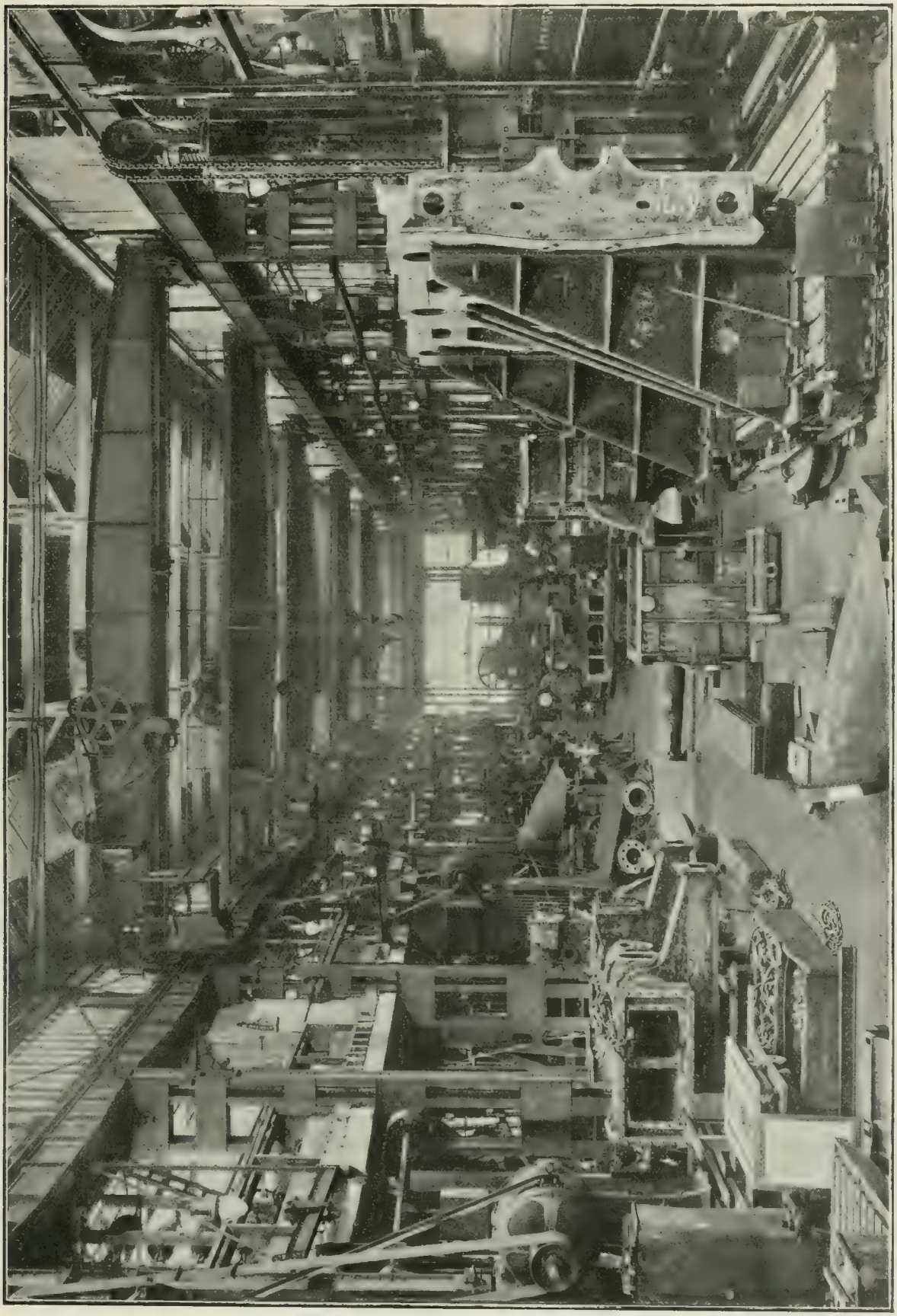
"TRIMAX" METALLIC PACKING.

A METALLIC packing which has been in considerable use is that shown in the adjoining illustration, and is put on the market by Messrs. A. McConwell & Co., of 21, Water Street, Liverpool. The diagram, which is partly sectional, clearly illustrates the mode of construction and action of the packing. It consists essentially of a special non-fusible and anti-frictional metallic compound ring



a fitted in halves about the rod, and provided with external conical portions, an inner gun metal ring, with conical interior, an outer ring of similar formation, an outer gun metal face ring and a turn of flexible packing.

The packing is made ¼ inch less in diameter than



Erecting Shop of Messrs. Wm. Doxford & Sons, Ltd., Sunderland.

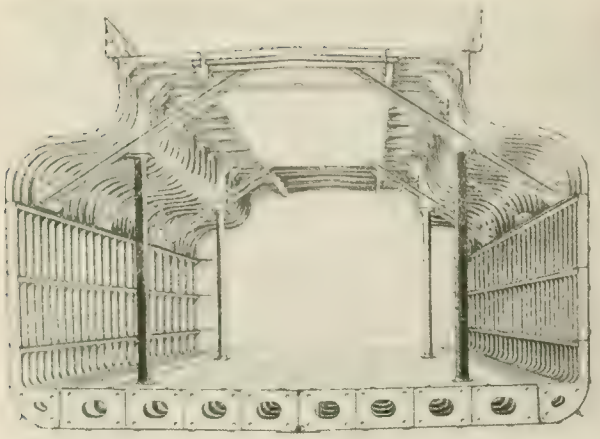


Fig. 3.

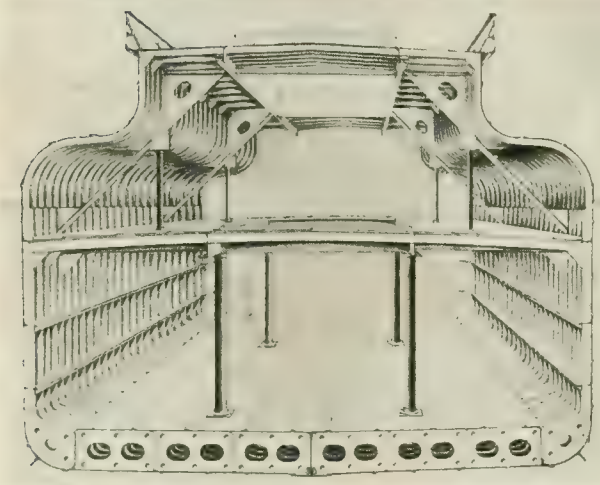


Fig. 4.

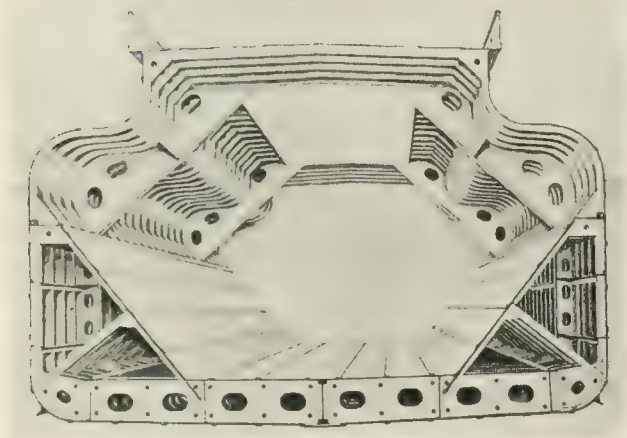


Fig. 5.

Fig. 1 illustrates a vessel for clear stowage, having a hold capacity of 58 feet per ton dead-weight and a dead-weight 2·6 times the nett register tonnage. Fig. 2 shows a construction without side webs. Fig. 3 shows a modified construction without side webs. Fig. 4 shows a special tween-deck construction for "liners." Fig. 5 shows a form of special construction for dead-weight trades, having a hold capacity of 50 feet per ton dead-weight and a dead-weight 3·1 times the nett register tonnage.

We give also a full-page plate illustrating the *S.S. Countess Warwick*, which is a typical turret vessel, built to carry 7,200 tons dead-weight on the moderate draught of 22½ feet by Messrs. Doxford & Sons.

Further we give another full-page plate illustrating the interior of the engine works in which the engines are built for the whole tonnage turned out of the shipyard of this firm.

Messrs. John Macdonald & Son, Engineers and Machine Tool Merchants, Glasgow, Newcastle, Birmingham and London, report that the volume of business in Air Compressors and Pneumatic Tools during the past year done by them has been much in excess of any previous year in their history, and that the pneumatic system of power generally has made great advance. Many shipyards and engineering works which formerly had small Air Compressing plants have been weeding these out, and putting down large central air power plants. Amongst the more outstanding orders secured by the firm for Ingersoll-Rand Air Compressors during the year, may be mentioned Messrs. Harland & Wolff, Belfast, for three large air compressors of an aggregate capacity of between 5,500 and 6,000 cubic feet of free air per minute, compressed to 100 lbs. pressure, and Messrs. Caird & Co., Greenock, two large electrically-driven air compressors. Other items were: two electrically-driven air compressors to the North Eastern Marine Engineering Co., one to Messrs. S. P. Austin & Sons, Sunderland, one to Messrs. Ruston Proctor and Co., Lincoln, also one to the North British Loco. Co., Glasgow, and a large number of smaller steam, electric, and belt-driven compressors to the general engineering trades. A decided feature of the year, Messrs. Macdonald & Sons report, has been the general wakening up to the fact of the saving in power necessitated in the driving of compound or stage compressors, over that required for single stage, wherever the size of plant warrants the adoption of this refinement. This they put down to the more intelligent interest displayed in the great possibilities of compressed air. The firm are now putting on the market a new pneumatic hammer, manufactured by the Ingersoll-Rand Co., and known as the "Crown" hammer. The tool is the simplest yet produced, and is built for economy, durability and hard work. The cylinder is case-hardened, thus ensuring a long life for same. It is the only hammer made which has a hardened cylinder. The valve is very simple, and working in a hardened steel box, it is not liable to wear, and can be very cheaply replaced, should the need for this ever arise. The valve is worked on an entirely different principle from the valves in all other tools, it being operated by differentiation of pressure on equal areas, whereas the valves of all other hammers are operated either by an equal pressure on a differential area, or by the older method of pressure and exhaust on either side alternately. The amount of air consumed, it is claimed, is much less than in any other type of hammer. The "Crown" hammers are made in all sizes for all classes of work.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondents.)

Portsmouth Dockyard.

WE have been having quite an exciting time at Portsmouth with the stokers' court-martial, the trial of Lieut. Collard, and the official commencement of our new ship. The last event took place on December 3rd, the first keel plate being laid by Admiral Sir Archibald Douglas, the Commander-in-Chief. Rear-Admiral Robinson, the admiral superintendent, thanked Sir Archibald for performing the ceremony and for the great interest he had taken in the work done by the officers and men of the yard, especially on the Dreadnought, which had the previous day completed her steam trials with such satisfactory results. He assured the commander-in-chief that the same keenness would be displayed with regard to the new ship. Admiral Douglas, in replying, expressed the hope that the new vessel would be as great a success as the first Dreadnought, which he knew had been well built. It has been decided that the vessel is to be called the *Bellerophon*, a name rich in historical associations. It was in a vessel of that name, it will be remembered, that the Emperor Napoleon was brought to England. The last Bellerophon (now the Indus III.) is moored in the Hamoaze at Devonport. The Dreadnought has had her complement brought up to full strength for special service, and at the beginning of the new year will leave for her experimental cruise. The *Terrible* has been docked for overhaul and repair, in addition to which she requires a new propeller and shafting, having lost her starboard propeller and a portion of the shafting when returning from China. The accident happened shortly after she left Hong Kong, but she accomplished the voyage home with one propeller at a good rate—about twelve knots. The old battleship *Sultan*, which has for several years been lying in No. 4 basin, is to be utilized at last. She has been ordered to be fitted up for service as part of the establishment for boy artificers, and will be roofed over and named *Fisgard IV.* No. 1 basin has been pumped dry in order that the work of pulling down and rebuilding the entrances to Nos. 3 and 4 Docks may be got on with, and this will occupy about two months. The basin is eventually to be used for submarines, a properly constructed basin for underwater craft being considered essential now that so many of them are extensively repaired by our staff. It will also be used for testing their submerging powers after repair. The War Office desires to let St. Helen's Fort, Spithead, and have advertised the fact, stating that the fort might be converted into a " small seaside hotel ! " The fort is about half a mile from the Isle of Wight, and connected with the island at low tide. It is the smallest of the Spit forts, and has not been occupied for some time; in fact, it is practically useless, for it is so close in shore that it is almost overlooked by a fort which has of late years been built on the island.

Devonport Dockyard.

It has been decided that our new battleship is to be named the *Temeraire*, a name famous in the annals of the Navy, and well known from Turner's picture " The Fighting Temeraire towed to her last berth." It is not generally known that the last *Temeraire*, an ironclad, built at Chatham thirty years ago, is still at this port. She is now, however, called the *Indus II.*, and engaged in the training of naval mechanicians. The new vessel will probably be officially laid down on New Year's Day. The blocks upon which she will be built reach several feet further up the slip than in the case of the cruiser *Minotaur*, which is the longest vessel built here. By the time she is commenced so much material will be ready to be worked into the hull that construction, especially in the earlier stages, should be fairly rapid, although, of course, no attempt will be made at racing with Portsmouth. At present about two hundred shipwrights and one hundred labourers are employed in the preparatory work. Exceptional measures have been adopted to ensure secrecy, and among other things wire netting is to be fixed at the end of the building slip facing the Hamoaze, so as to prevent persons obtaining a view of her progress from the harbour. In order that work on the ship may be expedited, the completion of the cruiser *Minotaur* is to be pushed forward and additional employés from the Constructive Manager's Department are to be transferred to her. The four funnels of the *Minotaur*, which have now been placed in position, are much shorter than those fitted to modern first-class cruisers. The engineers' work on the ship is considerably in advance of that in connection with the hull and fittings, and practically the whole of the machinery has been placed on board. The battleship *Hibernia* is, except for " cleaning up," now out of hand and has been docked at Keyham Extension to be prepared for her maiden commission. Her acceptance trials have proved satisfactory, and she will be immediately taken over by the Admiralty. She is to be commissioned on January 2nd for temporary service in the Atlantic Fleet, and subsequently as flagship of the second in command of the Channel Fleet. Vice-Admiral Sir Reginald Custance, whose flagship she will be, was on a visit to Plymouth in the middle of the month, and spent some time on board the vessel, with the general arrangements of which he appeared delighted. The cruiser *Gibraltar* is to be taken in hand early in the new year. The current Estimates contain provision for an expenditure of £31,164 on her. The work of adapting the cruiser *Spartan* for service as a torpedo drill ship is progressing steadily. The cruiser *Essex* is under orders to proceed to Portsmouth and join the Reserve Division there. The work in connection with her fire control fittings will probably be completed at Portsmouth, and the new search-light platform on her foremast will also be fitted at that port.

Chatham Dockyard.

Now that it has been settled that the *Dreadnought* is to be the flagship of the Home Fleet, which is to have its headquarters at Sheerness, the agitation to secure additional dock accommodation at Chatham is to be renewed. It is pointed out that if the *Dreadnought* should require to be repaired she would have to be towed to Portsmouth, and then no dock might be available there. The scheme for the further extension of this yard, it may be recalled, was approved by the Admiralty, and only abandoned when the idea of a naval base at Rosyth was mooted. As to Chatham's suitability for large vessels, there would be no difficulty in building a ship nearly half as long again as the *Dreadnought* on the new slipway. The question of breaking up obsolete ships at this yard has again been brought forward, and is being advocated in some quarters as a means whereby employment may profitably be found for some of the unemployed workmen in the district, and also avoid the necessity for further discharges in the constructive department. The Secretary to the Admiralty has promised to make inquiry into the matter, but in view of the fact that similar applications in the past have met with refusal, little hope is entertained of the suggestion being adopted. The battleship *Africa*, having carried out her commissioning trial, has returned in order to have some work in connection with the electrical fire control of her 12-inch guns completed. Other vessels here are the battleship *Ocean*, of the Channel Fleet, which is undergoing a refit; the cruiser *Leviathan*, which has just returned from the Mediterranean, and is being refitted previous to joining the new Home Fleet; and the battleship *Albermarle*, of the Channel Fleet. The latter vessel has almost completed her refit and is shortly leaving for Devonport, after which she will join the Atlantic Fleet as flagship of Rear-Admiral Egerton. The new cruiser *Warrior* has arrived from Pembroke to be docked and prepared for her steam trials. Altogether the outlook for the new year is not at all a bad one. Rear-Admiral Corry, who has in many ways shown the interest he takes in the welfare of the dockyard employés, is endeavouring to establish a club for the apprentices. He is a firm believer in officers and employés being brought into close touch with each other. The working expenses will be met by subscriptions, in connection with which the admiral-superintendent and the officers of the yard are prepared to render assistance. Such a club should prove of great value to the lads, while it would promote a feeling of unity which would be for the good of the service in general.

Sheerness Dockyard.

On New Year's Day the flag of the Commander-in-Chief at the Nore, which has been flown at Sheerness for something over a century, will be hauled down for the last time so far as this port is concerned. Admiral Sir Gerard Noel's flag will be hoisted and saluted as usual, but at sunset it will be hauled down and the commander-in-chief will take up his abode at Chatham. Admiralty House will then be unoccupied until Rear-Admiral Bridgeman comes in the spring to take command of the new Home Fleet. In view of the constitution of that fleet arrangements are being made to get together in the Medway a more powerful squadron than previously existed. With regard to the battleships, the *Magnificent* has arrived to take the place of the *Repulse*, and the *Victorious* is to come early next month on being relieved in the Atlantic Fleet, to replace the *Royal Oak*, which goes to Devonport. Then the cruiser *Leviathan* has taken the place of the *Aboukir*, which has gone to Devonport. All the changes that are to take place will strengthen the composition of the new fleet, and, with the *Dreadnought* at its head, it appears certain that the Sheerness-Chatham division of the Home Fleet will be composed of the best ships available after the Channel, Atlantic and Mediterranean Fleets have been reconstituted. The basing of such a number of large vessels here should help to provide work for Chatham Yard and make up for the diminution of new construction, in addition to which it will emphasise the need for the provision of floating docks at this port. A wise provision would appear to be the building of two or three such docks, 600 feet in length, and capable of lifting a vessel of 20,000 tons displacement, drawing thirty feet of water. There is plenty of room here for floating docks. The present dock at Bermuda, which can lift battleships of 15,000 tons displacement, was tested here, the battleship *Sanspareil* being placed in it. It is gratifying to know that the work of the yard is giving satisfaction to the Admiralty, notwithstanding that it has been of such a varied character lately. The information was conveyed by Captain Startin, the captain-superintendent, when addressing the apprentices attending the dockyard school at the recent distribution of prizes. Speaking of apprentices reminds me that one of the lads here has won a £50 Whitworth exhibition, the seventh Whitworth prize that has come to this yard in seven years.

Pembroke Dockyard.

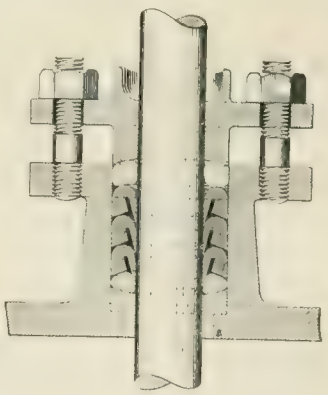
The armoured cruiser *Warrior* left here on December 18th for Chatham to be prepared for carrying out her trials. The main propelling engines, which were manufactured and fitted by the Wallsend Slipway and Engineering Company, were previously subjected to the contractors' preliminary steam trials with satisfactory results. The safety valves on the nineteen Yarrow water-tube boilers were also successfully tested. The hands which were employed on the *Warrior* have been transferred chiefly to the *Defence*. The work of fitting the teak wood backing on that vessel, which will form the seating for the side armour, is now well under way. Both backing and armour will be fitted and fastened on by the piece work system, that being considered to be the most economical method. Some of the men are to be employed on the *Aquarius*, to adapt her as a fleet workshop and repair ship, for which plans have been prepared and an estimate of £7370 approved. The *Warrior* after her return here should afford employment for a large number of men for three or four months, if the estimated expenditure for labour as shown in the Estimates is to be relied on. The *Defence* also, upon which about £112,000 will remain to be expended after April 1st, should be complete within the ensuing twelve months. In addition to this, which should suffice to keep us fully employed for a year, there will be the new "mother ship," which is to be commenced early in the next financial year. From all this the outlook appears very bright for the new year. The installation of electrical power in the various workships is now practically complete, and it is to be hoped that the authorities will now devote their attention to improving the general outdoor lighting arrangements of the yard, which are to some extent imperfect. Indeed, flare lamps have had to be used, and this will make lighting a very costly item during the dark months of the winter. Many of the men say they would prefer to knock off work at half-past four instead of an hour later, and have only half an hour for dinner.

"SEA-RINGS."

A High Pressure Packing.

IT would seem generally that such is the variety of design in the form and construction of packing for glands, the possibility of any marked improvement was very remote, but the continued research in engineering problems to improve the efficiency of motive power agents, result from time to time in the production of some device or manufacture of utility in the desired direction.

We illustrate in the adjoining diagram the new type of packing which is put on the market by Messrs. Ronald Trist & Co., of Coronation House, Lloyds Avenue, London, who are the managers for Great Britain of the Quaker City Rubber Co., of Philadelphia and Chicago. It will be noted the packing is formed with a "lip" or fine feather edge with a hollow space at the back so as to prevent any extra mechanical pressure from the gland from being transmitted to the rod, and allowing the rod a certain amount of lateral movement without restraint from the packing.



It will be noticed that instead of the conditions which usually obtain with ordinary packing, according to which gland pressure is always present to the full amount because the packing must always be screwed up tight enough to prevent leakage; with sea rings, only that pressure is necessary to keep the rings up to their work, the steam pressure doing the rest. It will thus be seen that the less pressure you are packing against, the less pressure the rings exert on the rod and at no time can the friction be greater than that absolutely necessary to prevent leakage.

It will we think, be recognized that great ingenuity and resource has been exercised in the production of a simple form of packing which complies to such a remarkable extent with the practical conditions which obtain in ordinary working.

One set, consisting of three sea rings, has lately run 14,000 miles in winter weather, and never been touched.

The firm are already manufacturers, and have been for many years, of the world-famous Daniels' P.P.P. rod packing.

ELECTRICITY ON BOARD SHIP.

IV.*

By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc. M.I.C.E., Etc.

The Commutator of the Continuous Current Machine.

THE brushes from which the current is taken to the field coils have been referred to in our last issue, and they are probably familiar to every marine engineer who has sailed with a dynamo. The brushes are the apparatus for collecting the current from the armature of continuous current machines. The armature coils of continuous current machines are wound in sections, the adjacent ends of adjoining sections being brought out and connected to a segment of the commutator, the brushes bearing upon the commutator and receiving the current from it. The reason for this arrangement is, the currents generated in the coils on the armature are really alternating, and the commutator and brushes are interposed to arrange them all in one direction, or to form them, as it is termed, into continuous currents. It is for this purpose that the coils are split up into sections. With a two-pole machine, that is, a machine in which there are only two electro magnet legs and two pole pieces, the armature coils are divided at every portion of the revolution into two halves. One half is generating current in one direction, the other half is generating current in the opposite direction, and the coils which are generating current in opposite directions are constantly changing as the armature revolves. The brushes are placed at the points where the change in the direction of the current generated in each coil would take place. It was mentioned in an earlier article that the lines of force pass across from one pole piece into the iron core of the armature, and out to the opposite pole piece. The conductors on the armature cutting the lines of force entering from one pole piece generate currents in the reverse direction to the conductors on the opposite side of the armature, which are cutting the lines of force as they pass out of the armature to the other pole piece. The lines of force spread round the armature core, and there are two practically neutral points where there are, or should be, no lines of force, and where each coil passes from the influence of one set of lines to that opposite set. It is at these points that the current in the armature coils is reversed, and it is at these points that the brushes are placed to receive the current. The currents generated in one half of the armature coils are in such a direction that they would pass out to the outer circuit, and they therefore deliver their current to what is known as the positive brush, the brush from which the current passes into the outer circuit. The other half of the coils generate currents in such a direction that they pass inwards, the returning current from the circuit meeting them at the brush, and passing inwards with them.

In the modern multipolar gencrator, the one described in an earlier article, in which there is an enclosing ring with field magnet cores radiating inwards, practically there are two or more machines combined in one. Each pair of field magnet cores with its pole pieces, and the piece of the armature between, constitutes a machine. Hence there are as many sets of brushes as there are field magnet cores, the currents generated in one half of the armature coils being still positive, while that generated in the other half is still negative, but the reversals take place at every quarter, one-eighth, or whatever the number of poles may be, instead of at every half revolution.

The construction of the commutator is the same for two pole and multipolar machines. It consists of a cylinder built up of segments of hard drawn copper, separated from each other by slabs of mica. Micanite is coming into use for the purpose. Each segment carries a short arm at its inner end, with a slot, into which the ends of the two wires from the adjacent coils are placed, the wires and the slot having been previously well tinned, and the whole are thoroughly sweated up together, in the larger machines a screw being added to increase the strength of the connection, the screw also being sweated after screwing up. The commutator cylinder, when built up, is held on the armature spindle, usually by a brass or iron sleeve, having discs at each end which fit into insulated recesses in the two ends of the commutator cylinder. The insulation of the commutator from the armature spindle and from the rings which hold it in place is one of the greatest difficulties the manufacturer of dynamos has to meet, and it is the point where armatures have a nasty knack of breaking down. In the early machines a groove was turned in each end of the commutator cylinder, sufficiently wide and deep to admit of a ring of wood. The ring of wood which was forced into this groove also had a groove turned in itself, and in these grooves the edges of brass discs, one for each side of the commutator, fitted, the whole being slipped on the armature spindle, and tightened up with nuts, the back ring of the commutator pressing against a projection on the spindle. The wooden ring, though it insulated fairly well for the pressures employed in those days, was mechanically weak. It must be remembered that motion is delivered to the commutator cylinder through the brass rings and the insulating rings referred to, and it is of the utmost importance that the segments of the commutator shall remain exactly in line with the ends of the coils to which they are connected. Too often the wooden rings split, the result being a burnt coil, as will be explained later. The wooden ring gave way to one of vulcanized fibre, but this was also not strong enough. In the modern dynamo the recesses in the ends of the commutator cylinders are made larger and deeper, and the insulating rings are made of micanite moulded under hydraulic pressure. Micanite is a substance made of small chips of mica, held together by some substance, such as one of the insulating varnishes, that are employed with armature coils. Mica is a very peculiar substance. The insulating properties of really good mica are very high indeed. Its insulation resistance is higher than almost any other known substance, and its resistance to sparking, which is also of very great importance, is very high. But unfortunately while mica can be had in considerable thickness, and almost as thin as you please, it can only be had in the familiar flaky form, in which, no matter what the thickness, the planes forming the two sides are always parallel. Further, it is rather brittle. In the different substances that have been formed from mica, of which micanite is the best known and the most important, the mica is made into chips, the chippings being preserved when plates are cut out for insulating the commutator segments, and so on, and these are made into a pasty mass, with the cohesive substance mentioned, the insulating varnish, and it is then moulded into various forms, the rings mentioned being one of them, these being made in a number of different forms and sizes, and the moulding is done under hydraulic pressure. When the commutator cylinder is put together, the rings are put in their places, and the whole squeezed up together by hydraulic pressure, this making a thoroughly satisfactory job.

The Brush Gear.

As the armature revolves, and as currents are generated in its coils, they are delivered to the commutator segments, with which the coils are connected, and the brushes which bear upon the commutator segments receive the currents from them, and deliver them to the outer circuit, the field coils, etc. Brushes are of two forms, copper and carbon. The term brush is employed because the original arrangements used by M. Gramme in his early machines, and for a long time afterwards, consisted of a brush of copper wires, held together by solder at one end, the other end being held in a shoe, and the loose end bearing upon the commutator segments. Carbon has largely taken the place of copper, because apparently there is less sparking. There is also less wear, provided the carbon brushes are properly proportioned, carbon itself, as is well known, having certain lubricating properties. But when carbon is employed it must present a surface to the commutator from two to five times as great as that presented by a copper brush, according to the size of the machine. At the present time there is considerable controversy, as usual, as to the virtues of carbon and copper for brushes. Copper brushes have been enormously improved in the last fifteen years, special forms having been introduced which it is claimed have another property possessed by the carbon, *viz.*, they offer an increased resistance at the moment of commutation, when the current in the coils is changing from one sign to the opposite. Copper has also the great advantage that not so many brushes are required, this

*For Articles I. to III., see last three issues.

following naturally from the fact that larger currents can be taken from the commutator through a copper brush of a given size, than a carbon brush of the same size, and therefore the commutator may be shorter.

Whether carbon or copper is employed, the brushes in either case are held in some form of shoe, which is carried on a spindle fixed parallel with the commutator cylinder, and carried by a disc, sometimes fixed on the bearing, and sometimes on the front of the enclosing ring of the machine, The disc, to which the brush spindles are attached, is usually called the rocker, or the brush ring. It was originally introduced because it was found advantageous, when the continuous current dynamo was being run, to be able to move the brushes forwards or backwards in the direction of the rotation of the armature, according as the current passing through the armature increased or decreased, this leading to the decrease of sparking. In the modern machine, though the rocker is provided, and in large machines an arrangement for moving it and its brushes bodily, usually a wheel, similar to the steering wheel of a motor car, or the valve of an engine, it is now not often used. The modern dynamo will stand considerable variations of load without showing any appreciable increase of sparking at the brushes. The rocker, however, forms a very convenient arrangement for carrying the spindles to which the brush shoes are attached. It is simply a ring, either clasping the bearing or fixed in brackets on the front of the field magnet ring, with projecting eyes opposite each field magnet pole, each eye carrying a brush spindle, the spindle being insulated from the rocker by a collar of insulating material. The brush shoes are of various forms, according to the fancies of different inventors and different makers, but they should all have the following points in common. It should be possible to throw any individual brush back from the commutator, and to trim it without stopping the machine, and providing the attendant has rubber gloves, without receiving a shock. It should also be possible to regulate the pressure with which each individual brush bears upon the commutator without stopping the machine.

THE ADVANTAGES OF A TECHNICAL SOCIETY.*

By the Hon. Secretary, Mr. James Adamson.

(*Continued from page* 162).

STILL, he can occasionally attend, and by so doing he comes into a fresh atmosphere of thought which tends to clear up the problems presented to his mind from the theoretical side at school or college, giving at the same time impetus to thought as well as a refreshing change to the mode of expression—from the scholastic experimental to the practical. The advantages of belonging to a technical society are thus many and great. The expansion of mind and thought at the most impressionable age become important factors when the direction of the necessary training in technicalities becomes more and more obvious, while the gradual process of becoming acquainted with technicalities, modes of thought and expression by speech in accurate words and language, which goes on through contact with fellow-members in the course of discussions, is invaluable to a young man just passing from his teens to his majority. What is learned in youth is taken into the memory—receptive to acquire knowledge more readily, and what is so learned is also more tenacious and less readily forgotten.

To the junior engineer whose experience of life is just widening out, and to whose intelligence the technical and theoretical, as well as the practical, side can appeal, the advantages of the technical society cannot be over-rated, as, added to the other advantages, there is the commercial aspect which is presented from time to time in the course of the papers and discussions, especially at the meetings, when the voice and the inflexions, which add life to the words, are listened to, giving a twofold interest and pleasure to the hearer. The young engineer has also the privilege of getting into touch with those in the society who are in advance of him in years and experience, and such is a considerable advantage. His own mode of thought ought to be, and probably is, different, due to difference in education and educational facilities, and—presumably—an improvement on those in vogue a generation previous, and by this much the junior has the advantage. He ought therefore to be able to assimilate more readily the views and experiences related in his hearing in the course of discussions. Progress and improvement are ever pressing on, moving towards, but never reaching, perfection.

In order to meet what one would naturally expect as an objection on the part of the juniors, there might be a section specially for and managed by themselves, but under the jurisdiction of the main council. Thus the diffidence which weighs with juniors, and militates against free discussion by them in the presence of their seniors, is removed, and confidence in expressing their thoughts is gained. The junior section may be a counterpart of the main body of the society, with papers prepared by juniors and lectures by the seniors specially suited for the juniors. Nor should the social element be overlooked; indeed, in connection with such a section there lie great possibilities in the hands of a good working convener and committee to develop in the right direction. As the hope of a country is in its youth, and the realization of that hope largely depends upon parental control and training—much more than upon the Education Act—so the hope of a technical society lies in the juniors—the coming generation, to whom the future of the society will have to be entrusted. It is therefore desirable that the society should be as the parent to its youthful members, not only acting as a finger-post, but as a mentor and friend.

It is profitable for those who are coming from the ranks to take positions of trust and responsibility, to meet and discuss matters of mutual interest with those who are a generation ahead of them in years and experience. Premising that the average of education and training is improving, the younger men ought to more readily incorporate experiences narrated to them with their own. Thus progress and advancement are ever on the move, and organizers and leaders of thought and action should ever be in the forefront directing the course to the highest ideal of life, ever ready to help and instruct those who are following after. It is by exercising the good points and the talents each one is endowed with, that these can be strengthened and added to at compound interest. The good is not given to be hoarded, but in the mental as well as in the moral world, he that is liberal in giving increases his store, while he that is the reverse tends to poverty of mind and soul.

One thought from the many by which Virgil enriched the literature of his day, and has given pleasure—well, perhaps pain indirectly—to all following ages, here occurs to the writer. When Æneas, as described in Book VI., has pointed out to him the refining process going on amid the fires of Hades, where the tarnished gold in man became purified, so long as it was gold and not tinsel, and his guide, probably interpreting the thought of the visitor that the process was a lengthy one in some cases, measured by mortal mind, said it was inevitable that the soul with ingrained evil which had entwined so wonderfully into the system should require much discipline and bear the full penalty due. Let the young take this thought to heart, and utilise their time to the best advantage, lest they wail and lament in after years on their lost opportunities and wasted hours, when the choice was theirs to make for the good and the useful.

Although the "Æneid" was written by Virgil on a request by Augustus and to exploit the Roman nation, there are fine thoughts and expressions throughout the epic, calculated, especially in the sixth book, to arouse patriotism and lofty ambition.

The engine builders and machine makers who are improving and modifying to get the best possible results out of their work in practice, look to those entrusted with the charge of machinery to keep themselves well ahead and posted up in all the changes taking place; hence the association with a technical society should be encouraged by all such makers, and this is the case more notably, no doubt, by some than by others. Education has been urged as a means to this end, but it is possible for a nation to be educated off the face of the earth, if such is the education which tends to a shudder at soiling the hands by hard work, and, engendering a false

* Read before the Institute of Marine Engineers, at 58, Romford Road, Stratford, E., on October 1st. Chairman, the Right Hon. Lord Pirrie.

pride, causes the victims to adopt a superficial manner of life —untaught to endure discipline, too eager for ease and show.

A man who is true to his business looks into the details regardless of the trouble or the soil around them; he takes a pride in his work, and has a courtesy towards it and towards those engaged in it.

Coming more immediately to a consideration of the Institute of Marine Engineers and the advantages accruing in connection therewith, it may be said that every marine engineer, whether junior or senior, ought to be associated with some grade of the membership, according to the qualifications of the appointment which he holds, and for this it should not be necessary to recapitulate in detail the reasons and grounds. The statement is made *ipse facto*, as it ought to go home to everyone who has the interests of his work at heart, as he realizes the enlarged and ever-growing possibilities which are in evidence around. The ever-present factor which is at work—competition, constant in pressure, inconstant in volume, but tending to increase as time goes on, with the old adage, "Necessity is the mother of invention," compels the inventor to roam into new pastures, embued with an idea to arrive at new methods or new materials to accomplish results by more direct or more economical means. In illustration of the former we have the triumph of persevering energy with which the name of one of our past presidents—the Hon. C. A. Parsons—is so closely associated, and of the latter we have the experiments and tests which are being carried out by several well-known firms, notably Messrs. Thornycroft on the Thames, and Messrs. Beardmore on the Clyde; the one, the latest in steam—an element the production of which by the combustion of coal, even with all the latest improvements, is so wasteful; the other, the latest development of the element which has proved itself to be much more economical than steam in producing mechanical power, the experiments in connection with which for marine propulsion are being watched closely and eagerly by engineers.

To sum up the few thoughts presented to you on the reopening of the session, and place in a concrete form the points touched upon, the following may be specially noted in connection with the subject:—

I. *Advantages to the individual member of whatever grade.*

In the direction of mental exercise, and consequent strengthening of the faculties of the mind. In the direction of finding out, in the course of discussions with fellow-craftsmen, how troubles in connection with details have been met and difficulties overcome. In the direction of social intercourse, and rubbing shoulders with those in like lines of life, exchanging experiences for mutual benefit. In the direction of encouraging a true feeling of *esprit de corps*, involving interesting and careful attention to details, pride and courtesy in one's work in all its relations.

II. *Advantages to the Community of which the members of the Society are units.*

In tending to improve the conditions of life and work all round. In tending to bring to the front, for the benefit of all, the latest improvements and developments. In tending to educate the general public in respect to the various aspects of the world of science, and to give the people a better understanding of things within the domain of science.

III. *Advantages to the Nation.*

In tending to improve the trade of the country by improving methods of manufacture. In tending to improve material and minimise risk of failure. In tending to lessen insurance premiums by lessening risk of breakages, stoppages, and disablements. In tending to the adoption of improved methods, material and appliances, with better conditions of upkeep and improved views in respect to upkeep and expenditure, to get the best results in immediate running and prospective life average, thus minimising cost and economising capital outlay, with consequent advantages in competing for the traffic of the world. In tending to reduce the cost of material and running expenses, and repairs, enabling employers to lessen the cost of output and make improvements in their plant to enable them to keep up to date in their works and factories with all competitors.

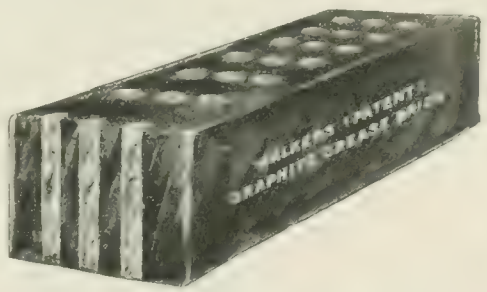
WALKER'S "KERKO" (PATENT) PACKING.

MANY of the difficulties in the working of ammonia plant for refrigerating work are due to the packing employed in the glands and other parts, and the necessity for maintaining the glands perfectly tight. In order to overcome these difficulties, Messrs. James Walker & Company, "Lion" Works, West India Docks, London, E., have designed a packing which they claim can be thoroughly relied on to meet every requirement.

This packing, which is shown in a sectional view in the above illustration, is composed of layers; one layer being a combination of white metal and fabric with an alternate layer of a specially prepared composition, in which the finest Flake Graphite is introduced. Owing to the lubricating qualities of the packing, any rod working in contact with it acquires a glass-like surface, and consequently the friction is reduced to a minimum, and the maximum of mechanical efficiency is obtained.

WALKER'S (PATENT) GRAPHITE GREASE-BRICKS.

IT will interest our readers to know that Messrs. James Walker & Co., the well-known manufacturers of "Lion" and other packings, have turned their attention to what, no doubt, engineers have long felt was required, namely, a lubricant of a special shape and nature for tunnel bearings. They have studied the matter very carefully, and are manufacturing a grease made in the form of a hard grease brick; it is perforated, as shown in accompanying illustration, and the perforations are filled with a softer grease, containing a large amount of the finest flake graphite.



The bricks are made in a handy form, to fit any tunnel bearing box, and are put face downwards, so that, as the shaft revolves, it carries with it a certain amount of the soft grease and graphite into the bearing, keeping it perfectly cool under the most trying circumstances.

BLAKE'S PATENT INTERNAL TUBE CUTTER.

AN ingenious form of internal tube cutter has been devised by Mr. Blake, Superintendent Engineer of the White Star Line, especially for use in removing tubes from boilers. We illustrate this tool in the adjoining illustrations, Figure 1 showing the tool complete and Figure 2 the various parts of the tool separated ready for assembling into its complete form.

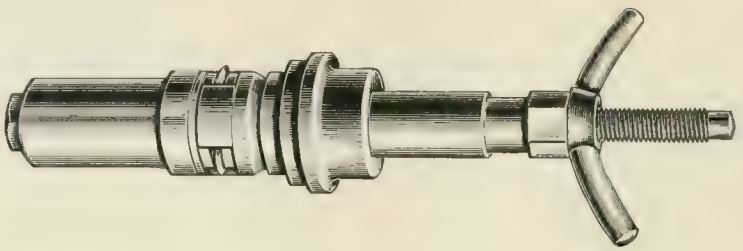


FIG. 1.

It will be observed from the illustrations that the tool consists of a central device having a screwed portion at one end and a conical portion with longitudinal grooves at the other. This is contained within a body portion having three recesses or slots into which are inserted blocks having an angular base, each carrying a cutting wheel. The angularity of the base of these blocks equals that of the conical end of the central bolt and the blocks are adapted to engage dove-tail fashion with one of the grooves in the central bolt. The blocks are further maintained in position in the body portion of the device by means of a collar which is screwed on to the latter.

A handle with a screwed nut at its centre is fitted to the central bolt and enables this bolt to be drawn into the body and force the cutters outwards.

An important feature of the device is that the cutters can be withdrawn from their work through the co-action of the blocks with the dove-tailed groove and thus the cutting wheels can be readily removed from the cut when the tube has been severed. This appears to us to be a most important feature. This tool is made to take a number of different sized tubes, for example, No. 1 size of tool takes from $2\frac{1}{8}$ to 3 in. inside diameter.

In order to enable the operator to use the cutter expeditiously in corners and in other difficult situations, free wheel ratchet handles, which work both right hand and left are supplied and as a matter of practice it has been found that a tube of $2\frac{1}{2}$ in. diameter and 8 B.W.G. thickness can be cut in $1\frac{1}{2}$ minutes.

The cost of the tool being very moderate, it will be readily appreciated that such cost can be readily covered by the saving of time and labour involved in the first box of tubes it removes.

The inventor has, in placing the tool upon the market, given it the title of " Speedy Lickemall " and the Bromell Patents Company, Limited, of 52, South Castle Street, Liverpool, who have the commercial handling of the matter placed in their hands, should have little difficulty in pursuading possible customers of the value of this tool as a labour-saving device.

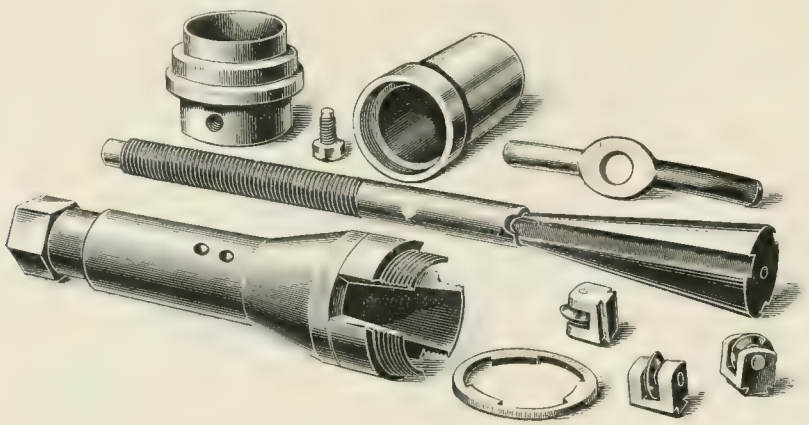


FIG. 2.

The South-Eastern and Chatham Railway Company, after having had experience of the " Stone-Lloyd " installation for hydraulically operating Water-tight Doors, as fitted on their latest vessels *Onward* and *Invicta*, for upwards of two years, have decided to adopt this installation on their new vessels at present building on the Clyde, and have given instructions accordingly to Messrs. W. Denny Bros., of Dumbarton, that these vessels are to be fitted with this installation, thus rendering them practically unsinkable.

Summary of Shipbuilding Returns of United Kingdom in 1906, arranged in order of Tonnage built by each Firm.

No.	Name of Firm.	Place.	No. of Ships.	Total Tons †
1	Swan, Hunter, Wigham-Richardson, Ld.	Tyne	25	126,921
2	Wm. Doxford & Sons, Ltd.	Wear	25	106,158
3	Harland & Wolff, Ld.	Belfast	11	83,238
4	Workman, Clark & Co., Ld.	Belfast	13	65,478
5	Russell & Co.	Clyde	14	63,338
6	Northumberland Shipbuildg. Co., Ld.	Tyne	11	51,400
7	Furness, Withy & Co., Ld.	Hartlepool	11	46,443
8	John Brown & Co., Ld.	Clyde	7	46,387
9	J. L. Thompson & Sons, Ld.	Wear	12	44,544
10	Wm. Denny & Bros.	Clyde	—	40,632
11	R. Stephenson & Co., Ld.	Tyne	12	39,131
12	Sir James Laing & Sons, Ld.	Wear	9	38,055
13	Palmers' Shipbuilding & Iron Co.	Tyne	7	37,940
14	Sir W. G. Armstrong, Whitworth & Co., Ld.	Tyne	15	36,814
15	Ropner & Son	Tees	11	35,890
16	Wm. Hamilton & Co., Ld.	Clyde	9	35,309
17	Barclay, Curle & Co., Ld.	Clyde	6	33,608
18	D. & W. Henderson & Co., Ld.	Clyde	6	33,187
19	Hawthorn, Leslie & Co., Ld.	Tyne	8	32,650
20	Irvine's Shipbld. & Dry Docks Co., Ld.	Hartlepool	9	32,131
21	Charles Connell & Co., Ld.	Clyde	7	31,105
22	J. Readhead & Sons	Tyne	8	30,205
23	Craig, Taylor & Co., Ld.	Tees	7	28,521
24	Grangemouth & Greenock Dockyard Co.	Clyde	10	28,460
25	R. Craggs & Sons	Tees	8	28,314
26	Caird & Co., Ld.	Clyde	4	26,778
27	Vickers, Sons & Maxim, Ld.	Barrow		26,770
28	Sir Raylton Dixon & Co., Ld.	Tees	8	26,610
29	Short Bros., Ld.	Wear	6	25,393
30	Archd. McMillan & Son, Ltd.	Clyde	8	23,276
31	Scott's Shipbld. & Engineering Co., Ld.	Clyde	11	23,179
32	A. Stephen & Sons, Ld.	Clyde	6	22,981
33	William Beardmore & Co., Ltd.	Clyde	2	21,050
34	Fairfield Shipbuilding Co., Ld.	Clyde	5	20,043
35	W. Pickersgill & Sons	Wear	5	19,970
36	A. Rodger & Co.	Clyde	8	19,894
37	Sunderland Shipbuilding Co., Ld.	Wear	8	19,241
38	Bartram & Sons	Wear	5	18,465
39	J. Blumer & Co.	Wear	7	18,387
40	Tyne Iron Shipbuilding Co., Ld.	Tyne	5	17,340
41	Earle's Shipbuilding & Eng. Co., Ltd.	Humber	15	14,228
42	London & Glasgow Shipbuilding Co.	Clyde	3	13,154
43	Robert Thompson & Sons	Wear	4	13,079
44	Gourlay Bros. (Dundee), Ld.	Tay	6	12,639
45	Caledon Ship & Eng. Co., Ld.	Tay	7	12,570
46	Clyde Shipbuilding & Engin. Co., Ld.	Clyde	5	11,096
47	Osbourne, Graham & Co.	Wear	6	10,806
48	Napier & Miller, Ld.	Clyde	3	10,740
49	R. Duncan & Co., Ld.	Clyde	3	10,710
50	Ailsa Shipbuilding	Clyde	32	9,368
51	Cammell, Laird & Co., Ld.	Mersey	8	8,541
52	Blyth Shipbuilding Co.	Blyth	8	8,496
53	S. P. Austin & Son, Ld.	Wear	4	8,370
54	Cochrane & Sons	Humber	33	7,940
55	Mackie & Thomson	Clyde	19	7,920
56	Smith's Dock Co., Ld.	N. Shields	28	7,743
57	John Reid & Co., Ld.	Clyde	10	7,664
58	Fleming & Ferguson	Clyde	8	7,360
59	Cook, Welton & Gemmell, Ltd.	Humber	35	7,355
60	David J. Dunlop & Co.	Clyde	5	6,884
61	Simons & Co., Ld.	Clyde	11	6,350
62	Bow, McLachlan & Co., Ld.	Clyde	19	5,659
63	John Crown & Sons, Ld.	Wear	4	5,638
64	Hall, Russell & Co.	Aberdeen	24	4,678
65	Lobnitz & Co.	Clyde	11	4,539
66	A. W. Robinson & Co.	Thames	26	4,229
67	R. Williamson & Son	Mersey		3,899
68	Campbeltown Shipbuilding Co.	Campbeltown	3	3,802
69	Ramage & Ferguson, Ld.	Forth	5	3,788
*1	Wm. Gray & Co., Ld.	Hartlepool	24	85,111
*2	Richardson, Duck & Co.	Tees	7	31,517
*3	Wm. Dobson & Co.	Tyne	7	24,811
*4	John Priestman & Co.	Wear	4	15,403
*5	Wood, Skinner & Co., Ld.	Tyne	9	11,103

† Board of Trade gross tons register.
* Board of Trade gross tons register including erections.

List of Vessels Launched in 1906.

ENGLISH.

THE TYNE, &c.

By W. P. Huntley, Hebburn.

Name of Vessel	Built of	Class	Owners	G T Regis.	I H P
Elizabeth	Wood	Sail	Native	25	—

By Sir W. G. Armstrong, Whitworth & Co., Ltd., Elswick Works, Newcastle-on-Tyne.

Salatis	Steel	Steam	German	4,775	2,900
Polyphemus	,,	,,	British	4,968	3,100
Hermione	,,	,,	,,	4,519	2,600
Goliath	,,	,,	,,	498	500
Sakkarah	,,	,,	German	4,691	3,000
Serak	,,	,,	,,	4,703	3,000
San Cristobal	,,	,,	British	2,041	1,350
Charcas	,,	,,	,,	5,067	3,500
Bosphorus	,,	,,	Turkish	52	130
,,	,,	,,	,,	52	130
Sisak	,,	,,	German	4,690	3,000
Bosphorus Nos. 59 and 60	,,	,,	Turkish	327ea	450ea
Bosphorus Nos. 55 and 56	,,	,,	,,	52ea	130ea

By Blyth Shipbuilding Co., Ltd., Blyth.

N.E.R. Co., 5, 6, 7 and 8	Steel	-	Native	460ea	—
† Sheaf Field	,,	Steam	,,	1,533	960
† —132—	,,	,,	Foreign	3,670	1,650
† Lady Furness	,,	,,	,,	1,268	950
Rock Breaker	,,	-	Native	185	—

By Wm. Dobson & Co., Newcastle.

3 Cargo Steamers	-	—	British	24,811 total	13,650 total
4 ,, ,,	—	-	Foreign		

By J. T. Eltringham & Co., South Shields.

† St. Olive	Steel	Steam	Native	203	420
* H.P. and H.C. No. 4	,,	,,	,,	402	600
Newport No. 5	,,	Towing	,,	300	—
† Braconheath	,,	Steam	,,	201	360
† St. George	,,	,,	,,	215	420
† Saxon Prince	,,	,,	,,	250	400

By R. & W. Hawthorn, Leslie & Co., Ltd., Hebburn-on-Tyne.

Antilochus	Steel	Steam	British	9,011	6,500
Cuthbert	—	,,	,,	3,564	3,000
Rupara	—	,,	,,	1,368	1,800
Port Hunter	-	,,	,,	4,063	3,000
Port Augusta	-	,,	,,	4,063	3,000
Port Phillip	—	,,	,,	4,061	3,000
Antony	—	,,	,,	6,360	5,000
Active	—	,,	,,	160	1,000

By Hepple & Co., Ltd., South Shields.

† Bertha	Steel	Steam	British	208	420
* Laura	,,	,,	Foreign	20	120
* Prompt	,,	,,	British	213	300
* Artificer	,,	,,	,,	270	350

† Triple * Compound

By The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P.
Purley, Bramley and Farley ..		—	British	4,725ea	2,000ea
Foxley		—	..	4,725	2,300
Belle of Ireland and Balaclava.	—	—	British	4,725ea	2,300ea
Asgard and Wan-gard	—	—	Foreign	4,725ea	2,000ea
Utgard	—	—	..	4,725	2,000
England ..	-	—	British	4,150	1,900
Irmingard	—	—	Foreign	4,725	2,000

By Palmers' Shipbuilding and Iron Co., Ltd., Jarrow-on-Tyne.

H.M.S. Lord Nelson	Steel	Steam	British	16,590 d	16,750
Destroyer	..	..	..	420d	7,200
Brasilia	..	..	Foreign	6,682	2,800
Sir Wm. Stephenson	..	..	British	1,540	2,200
Barrington Court	..	..	..	4,368	1,900
Guardiana ..	..	..	..	6,890	3,200
Lightship	Iron	—	..	450d	-
King Malcolm }	machinery	—	—	—	1,900
King Howel }	only	—	—	—	1,900

By J. P. Rennoldson & Sons, South Shields.

‡‡Abeille XII. ..	Steel	Steam	Foreign	261	940
* Roman	..	..	British	108	410
Marsden	..	..	..	130	350
Hendon	..	..	..	130	350
‡‡Lady Crundall ..	..	..	..	366	1,530
* Mode Wheel ..	..	..	..	130	500

By Smith's Dock Co,, Ltd., North Shields.

779	Steel	Steam		367	480
785	..	..	—	221	375
787	..	..		1,104	700
788	..	..	—	256	420
789	..	..	—	257	405
790 and 791 ..	..	..	—	220ea	380ea
792	..	..		231	400
793	..	..	—	294	520
794 and 795 ..	..	..	—	258ea	525ea
796, 797 and 800	..	..	—	214ea	400ea
798 and 799 ..	..	..	—	215ea	400ea
802	..	..		271	480
803	..	..	—	174	370
804	..	..		226	400
805	..	..	—	227	375
806	..	..	—	302	520
807	..	..	—	295	480
808 and 809 ..	..	..	—	260ea	420ea
813 and 814 ..	..	..		210ea	400ea
815	..	..	—	230	400
337	..	..		320	520

By Robert Stephenson & Co., Ltd., Hebburn-on-Tyne.

King Edward ..	—	—	British	4,356	1,800
Tiverton	—	—	..	3,824	1,700
Okehampton ..		—	..	3,875	1,950
Sommerstad ..	—	—	Foreign	3,850	1,700
Iris	—	—	British	475	1,500
Daffodil			..	475	—
King Howel ..	—		..	4,342	1,900
Edmonton ..		—	..	1,982	1,100
King Malcolm .		—	..	4,351	1,900
Ethelwolf ..			..	4,317	1,800
Cliftonhall ..		—	..	3,640	1,950
Crossby	—	—	..	3,634	1,700

‡‡ Compound Surface Condensing. * Compound.
‡ High Pressure.

By Swan, Hunter & Wigham Richardson, Ltd., Wallsend and Walker-on-Tyne.

Name of Vessel.	Built of	Class.	Owners	G T Regis.	I.H.P
at Mauretania ..	—	-	British	33,000	70,000
† Enosis	-		Foreign	4,054	1,950
† Holger	-	—	..	6,416	3,600
† Osmanieh ..	—	—	British	4,050	6,800
† Aydon	—	-	..	3,836	1,700
† Bella	—	-	..	1,272	1,600
† Amelia	—	—	..	1,271	1,600
t† Immingham ..	-	—	..	2,009	7,000
† Winona	—	-	Colonial	2,136	1,140
† Bendu	—	—	British	4,743	2,400
† Sandon Hall ..	—	—	..	5,578	2,750
† No. 777	—		—	5,550	2,900
† Arawa	—	—	..	9,300	5,650
† Serapia	—	—	Foreign	5,262	2,400
† Liamone	—	-	..	1,392	3,500
† Mersey	-	-	British	1,383	2,600
† Empress	—	—	Colonial	1,351	3,000
† Dochra	—	—	British	4,872	2,000
† Irwell	—		..	1,405	2,600
a Braunfels ..	—	—	Foreign	6,255	2,800
† Corte	—	-	..	1,375	3,500
a Goslar	—	—	..	5,522	2,800
Kittiwake	—	—	British	2,280	1,750
a Lindenfels ..	—	—	Foreign	6,303	2,800
a Rauenfels	—	—	..	6,306	2,800

By Tyne Iron Shipbuilding Co., Ltd., Willington, Quay-on-Tyne.

† Tricolor	Steel	Steam	Foreign	4,029	1,850
† Antar	..	..	British	3,580	1,900
† Denewell	..	..	..	3,091	1,650
† Goathland ..	..	..	..	3,080	1,750
† Wheatfield ..	..	..	..	3,560	1,900

By Wood, Skinner & Co., Ltd., Newcastle-on-Tyne.

† Carl	Steel	Steam	Foreign	1,213	940
† Ragnar	..	..	..	1,212	940
† Birtley	..	..	English	1,438	1,050
† Horden	..	..	..	1,434	1,050
† Cygnus	..	..	Foreign	1,164	950
† Ariel	..	..	..	1,760	1,100
† John O. Scott	..	..	English	1,235	1,000
† Vera	..	..	Foreign	1,206	950
† B.F.	..	..		441	550

By John Readhead & Son, South Shields.

Treneglos	—	-	—	3,886	2,000
Tremayne	—	—		3,882	2,000
Christian Michelsen	-	-	-	3,559	2,000
Don Diego ..	—	—	—	3,032	2,000
King Idwal ..	—	—		3,031	2,000
Ellerslie	—	—	—	3,854	2,000
Ellaline	—	—	—	3,875	2,000
Trelawny	—	-	—	3,886	2,000

THE WEAR, &c.

By S. P. Austin & Son, Ltd., Sunderland.

Name of Vessel.	Built of	Class.	Owners	G T Regis	I.H.P
† Brook	Steel	Steam	British	1,435	950
† Tosto	..	..	..	1,755	1,300
† Lady Cory-Wright	..	..	..	2,463	1,500
† Hampshire ..	..	..	..	2,717	1,600

By Bartram & Sons, Sunderland.

**Rochdale	Steel	Steam	British	3,717	1,430
**South Wales ..	..	..	..	3,667	1,480
** Aldersgate ..	..	..	..	3,687	1,430
**Towergate ..	..	..	..	3,696	1,430
**No. 205	..	..	..	3,695	1,430

a Quadruple. *at* Quadruple Turbine. *t*† Turbine Triple.
† Triple. ** Triple Compound.

By John Blumer & Co., North Dock, Sunderland.

Name of Vessel.	Built of	Class.	Owners	G.T Regis	N.H.P.
Olivemoor ..	Steel	—	British	2,743	257
Riversdale ..	.	—	,,	2,805	271
Marstonmoor ..	.	—	,,	2,744	262
St. Paul	,,	—	Foreign	2,562	271
Ennisbrook ..	.	—	British	2,823	262
Karnak	.	—	,,	3,179	324
Holywood ..	.	—	,,	1,540	214

By J. Crown & Sons, Ltd., Sunderland.

† Trafalgar	Steel	Steam	Foreign	2,206		175
† Rawchite	,,	,,	British	866		99
‡ Croxdale	,,	,,	,,	1,283		112
‡ Tudhoe	.	,,	,,	1,283		112

By Wm. Doxford & Sons, Ltd., Pallion Yard, Sunderland.

					I.H.P.
Glenesk	—	—	British	3,345	1,250
Breconian	—	—	.	4,406	1,500
Penycarn	—	—	.	3,758	1,350
Drumcondra ..	—	—	.	5,139	2,100
Blake	—	—	.	3,788	1,350
Drumeldrie ..	—	—	.	5,059	2,100
Newbridge ..	—	—	.	3,785	1,350
Nonsuch	—	—	..	4,125	1,700
Gaisa	—	—		4,174	1,500
Silverdale and Elgin	—	—		4,137ea	1,500ea
Irismere	—	—		3,717	1,350
Mersario	—	—	.	4,199	1,500
Tredegar Hall ..	—	—		3,812	1,350
Newbiggin ..	—	—	.	4,138	1,500
Countess Warwick and Ryall	—	—		4,137ea	1,500ea
Fairport	—	—		4,137	1,500
Holland, Royal Sceptre,, Duffield and Billiter	—*			4,137ea	1,500ea
Kattenturm ..	—	—	German	6,700	2,600
Euphorbia and Billiter Avenue	—	—	British	4,137ea	1,500ea

By Sir James Laing & Sons, Ltd., Deptford Yard, Sunderland.

Duendes	—	Steam	—	4,452	3,000
Roma	—	,,	—	1,620	1,690
Berlin	—	,,	—	1,921	1,690
Esmeraldas ..	—		—	4,491	3,000
Flamenco ..	—	,,	-	4,539	3,000
La Blanca ..	—		—	6,813	4,000
El Argentino ..	—	.	—	6,813	4,000
Re D'Italia ..	—	.	—	6,804	5,250
Small Craft ..		,,	—	900	-

By Osbourne, Graham & Co., Sunderland.

‡ Trym	Steel	Steam	Norwegian	1,802	1,100
‡ King Edward ..	..	.	Danish	1,280	800
† Malinche			British	1,809	1,000
† Kaiapoi		..	,,	2,004	1,100
† Marlwood ..	.	.	,,	1,981	1,100
† Westhampton ..		..	.	1,870	1,000

By Wm. Pickersgill & Sons, Sunderland.

Shira	—	—	British	3,755	—
Saint Patrick ..	—	—	.	4,256	—
Kildale	—	—	,,	3,820	-
Alconda	—	—	,,	4,298	-
Skipton Castle ..	—	—		3,830	-

By J. Priestman & Co., Sunderland.

† Barnby ..	Steel	Steam	Native	4,761	[illegible]	2,174
‡ Times	..	..	Foreign	2,394	[illegible]	1,540
‡ Hornelen ..	..	.	Foreign	4,245	[illegible]	1,900
‡ Paralos ..	..		Native	4,[illegible]	[illegible]	1,900

†Triple.

By Sunderland Shipbuilding Co., Ltd., South Dock, Sunderland

Name of Vessel.	Built of	Class.	Owners	G.T. Regis.	I.H.P.
Cambric	Steel	—	British	3,402	1,876
Austa	,,	—	Foreign	1,119	787
Asiatic	,,	—	British	3,592	1,876
Republic	,,	—	,,	4,281	2,146
Magnus	,,	—	Foreign	1,296	889
Flawyl	,,	—	British	3,592	1,936
Halfdan	,,	—	Foreign	1,307	889
242 s.s.	,,	—	,,	652	600

By Robert Thompson & Sons, Ltd., Southwick Yard, Sunderland.

**Arndale	Steel	Steam	British	3,557	1,500
**Skogstad	,,	,,	Foreign	3,640	1,910
**Pelham	,,	,,	British	3,534	1,500
**Cedargrove ..	,,	,,	,,	2,348	1,000

By Short Bros., Ltd., Sunderland.

Don Benito ..	—	—	British	3,748	1,300
King Frederick	—		,,	3,755	1,700
Andriana	—	—	Foreign	2,057	1,300
Haydn	—	—	British	3,923	1,579
Anglo Bolivian	—	—	,,	5,503	3,000
Chipana	—		,,	5,505	3,000

By Joseph L. Thompson & Sons, Ltd., Sunderland.

Finn	—	—	Foreign	3,803	2,100
Gorsefield ..	—	—	British	3,740	1,930
Don Cæsar ..	—	—	,,	3,055	1,700
Waltham	—	—	,,	3,636	1,840
Charlton	—	—	,,	4,017	1,960
Aboukir	—	—	,,	3,660	2,020
King John ..	—	—	,,	3,664	1,700
Don Emilio ..	—	—	,,	3,651	1,700
King Lud ..	—	—	,,	3,650	1,700
Wearbeck ..	-	—	,,	3,796	2,100
Gjoa	—	—	Foreign	3,030ap.	1,840
Wintringham ..	—	—	British	3,036	1,840

THE TEES, HARTLEPOOLS, &c.

By Sir Raylton Dixon & Co., Ltd., Middlesborough.

Name of Vessel	Built of	Class.	Owners	G T Regis.	I H.P.
† Lusitania	Steel	Steam	Foreign	5,557	5,000
† Parkwood	,,	,,	British	1,779	1,200
† Borgestad	,,	,,	Foreign	3,944	2,567
† Fritzöe	,,	,,	..	3,955	2,567
† Fornebo	,,	,,	..	3,918	2,567
† Bangarth	,,	,,	British	1,875	1,580
† Henrik Ibsen ..	,,	,,	Foreign	4,578	2,600
† Manica	,,	,,	.	1,004	721

By Furness, Withy & Co., Ltd., Hartlepool.

285	—	Steam	British	3,927	—
290	—	,,	..	4,187	—
291	—	,,	.	4,203	—
292	—	,,	..	4,168	—
293	—	,,	..	4,197	—
294	,,	,,	..	4,187	—
295	—	,,	,,	3,906	—
296	—	,,	..	4,575	—
297	—	,,	,	4,184	—
298	—	,,	..	4,186	—
299	—	,,	,,	4,723	—

By R. Craggs & Sons, Ltd., Middlesbrough.

Trader	—	—	British	3,608	2,100
St. Andrews ..	—	—	..	3,613	2,100
Parkgate	—	—	..	3,232	1,450
Fimreite	—	—	Foreign	3,807	1,750
Kossuth	—	—	..	3,5[illegible]3	1,950
King George ..	—	—	British	3,852	1,750
Toftwood	—	—	..	3,082	1,450
Helredale	—		..	3,567	1,700

† Triple ** Triple Compound.

By W. Gray & Co., Ltd., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
Harperley	—	Steam	British	4,903	2,000
Monaro	—	..	Colonial	2,907	1,250
Rubens	—	..	British	3,754	1,700
Marchioness of Bute	—	..	..	4,741	2,000
Llanwern	—	..	..	4,744	2,000
Trinity	—	..	..	4,057	2,000
Harewood	—	..	..	3,489	1,500
Buxton	—	..	..	3,518	1,500
Aagot		..	Foreign	3,975	1,700
Dan and Ute ..	—	..	..	2,105ea (including extensions)	1,100ea
Antiope	—	..	British	3,383	1,500
Stegelborg ..		..	Foreign	2,114	1,000
Cresswell	—	..	British	3,480	1,500
Harlyn	—	..	..	4,657	2,000
Mathilda	—	..	Foreign	4,423	2,000
Alexandra ..	—	..	British	3,448	1,500
Skogland	—	..	Foreign	3,304	1,700
Ben Lomond ..	—	..	British	3,169	1,500
Tangistan ..	—	..	..	4,155	1,700
Headley		..	..	4,713	2,300
Ravelston	—	..	..	2,392	1,200
Veraston		..	..	2,084	1,000
Dirphys	—	..	Foreign	3,431	1,500

By Wm. Harkess & Son, Ltd., Middlesborough.

†	Taarnborg ..	Steel	Steam	Foreign	1,234	625
†	Orland	,,	,,	,,	1,464	950
†	Faithful	,,	,,	British	874	850

By Irvine's Ship Building and Dry Dock Co., Ltd., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
Evelyn	—	Steam	British	3,970	1,600
Gutrune	—	,,	Foreign	3,750	2,000
Gunther	—	..	,,	3,748	2,000
Ribston	—	,,	British	3,458	1,500
Snowdon Range	—	..	..	3,470	1,500
Ripon	—	,,	..	3,375	1,500
Maude	—	,,	..	3,405	1,600
Linda Fell ..	—	,,	..	3,445	1,500
Myra Fell ..	—	,,	..	3,450	1,500

By Richardson, Duck & Co., South Stockton Iron Shipyard, Stockton-on-Tees.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
Achilbster ..	—	Steam	British	4,855	1,900
Eda	—	,,	,,	2,871 (including extensions)	1,400
Thirlwall	—	,,	..	3,628	1,450
Patagonia	—	,,	..	5,473	2,200
Picton	—	,,	..	5,473	2,200
Diadem	—	,,	..	4,074	1,700
Hartland	—	,,	..	5,143	1,950

By Ropner & Son, Stockton-on-Tees.

†	City of Cardiff	Steel	—	British	3,089	1,450
†	Upcerne	,,	—	,,	2,984	1,420
†	Hopper Barge	,,	—	,,	698	450
†	Rollesby	,,	—	,,	3,954	1,800
†	Antaeus	,,	—	,,	3,061	1,450
†	Maltby	,,	—	,,	3,970	1,800
†	Ethyl	,,	—	,,	3,082	1,400
†	Millpool	,,	—	,,	4,218	1,850
†	Blackfriargate	,,	—	,,	2,790	1,300
†	Camphill	,,	—	,,	3,820	1,770
†	Clearpool	,,	—	,,	4,218	1,850

By Craig, Taylor & Co., Ltd., Stockton-on-Tees.

†	Don Arturo ..	—	—	British	4,158	1,700
†	King David ..	—	—	Foreign	4,158	1,700
†	Thistlemor ..	—	—	British	4,850	1,900
†	Edernian	—	—	,,	4,112	1,866
†	Antigone	—	—	,,	3,031	1,455
†	Glamorgan ..		—	,,	4,102	1,840
†	O. A. Knudsen	—	—	Foreign	4,110	1,840

† Triple.

THE HUMBER, &c.

By Thomas Dobson & Co., Hessle-Haven.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
Gral San Marlin and Francisco Alba	Steel	Sail	Foreign	250ea	—
Frances and Crichton		Lighters	Hull	100ea	—
Rio Yguazu		Steam	Foreign	450	600
Vessel	,,	Sail, in sections	,,	500ab	—

By Cochrane & Sons, Ouse Shipbuilding Yard, Selby.

Clifton	Steel	Steam	British	242	450
2 Trawlers ..	..	..	..	270ea	450ea
Umballa	..	..	..	249	450
Thistle	..	..	..	228	430
Aries and Lynx	..	..	..	249ea	480ea
Helcia	..	..	..	229	480
Father O'Flynn	..	..	..	223	450
2 Trawlers ..	..	..	..	251ea	450ea
Hercules and Hector	..	..	..	238ea	450ea
Vesper	..	..	..	263	450
Liberia and Ormonde	..	..	..	250ea	430ea
Tokio	..	..	..	220	430
Ophir	..	..	..	212	450
Manx Queen ..	..	..	..	218	430
5 Trawlers ..	..	..	..	224ea	430ea
3 Trawlers ..	..	..	..	254ea	450ea
2 Trawlers ..	..	..	..	270ea	530ea
Bombay	..	..	..	230	450
Nora Niven ..	..	..	Colonial	150	260
President	..	..	British	260	450
Ruby	..	..	..	260	530

By The Goole Shipbuilding & Repairing Co., Ltd., Goole.

†	Evelyn	Steel	Steam	British	234	480
*	Lilian	,,	,,	..	320	430
†	Anacaona ..	,,	,,	..	233	480
†	Tees	,,	,,	..	507	480
†	Marion	,,	,,	..	239	400
†	Coot and Grebe	,,	,,	,,	172ea	300ea
	Oceania	,,	Sail	Foreign	752	—
†	Margaret	,,	Steam	British	297	500
†	Merlin and Oriole	,,	,,	,,	172ea	300ea
†	Siluria	,,	,,	,,	207	380

By Henry Scarr, Hessle, Hull.

	Kate	Steel	Sail	English	Carrying capacity.	140	—
	Yorkshireman ..	,,	Barge	,,		190	—
	Fire King ..	Iron	Steam	,,		70	—
*	Cygnet	Steel	Steam	,,		170	140 bhp
	Enery and Nellie	,,	Sail	,,		130ea	—
*	Fme	,,	Steam	,,		200	80
	No. 1	,,	Barge	,,		60	—
	.. .. ..	,,	Steam	,,		50	—
	.. .. ..	,,	Buoy	,,		30	—

By J. Scarr & Son, Beverley and Howden, Yorks.

	Nos. 21, 23, 24, and 26	Steel		Native	111ea	—
	Runic, Iona, Sunda & Nera	,,	—	,,	93ea	—
	Yokefleet	,,	Sail	,,	—	—
*	Rosie	,,	Both	,,	115	—
	Nos. 244 and 246	,,	Sail	,,	—	—
	Nos. 22 and 25 ..	Steel	—	Native	111ea	—
	No. 231	,,	Sail	,,	—	—
	Sheikh & Wooda	,,	—	,,	93ea	—
	No. 245	,,	—	,,	—	—

† Triple. * Compound.

By W. H. Warren, New Holland.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
Kestrel, Lapwing, Merlin and Nuthatch ..	Steel	Lighters	Hull	245ea	
David and Anderson		Sail	Grimsby	170ea	
Leda and Lichard			British	136ea	
No. 2		Lighter	Grimsby	130	
Tug	,,	—	,,	140	[illegible]
Lighter			Hull	25	

By Earle's Shipbuilding & Engineering Co., Ltd., Hull.

Name of Vessel.	Port of Register.			I.H.P.	Press. lbs.
King Lear and Cæsar			British	[illegible]	Hull only
Gladys	—	—	,,	275	450
Oslo	[illegible]			2[illegible]	1,800
Whitemans ..	—			280	500
Indo				[illegible]	600
Mourmo and Kolpino ..	—			810ea	850ea
North King and Spider	—	—	,,	271ea	500ea
Brutus				311	(Hull only)
Leno and Lebu			Foreign	2,[illegible]80ea	1,600ea
Myton and Venture	—	—	British	288ea	[illegible]

I.H.P. of Machinery for Renewals and vessels built elsewhere 7,550

By Cook, Welton & Gemmell, Ltd., Beverley.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
† 15 Vessels ..	Steel	Steam	British	173ea	280ea
† Aruba		,,		210	430
† 3 Vessels	,,	,,		258ea	450ea
† Regal		,,	,,	212	400
† 2 Vessels	,,	,,		282ea	500ea
† Pretoria	,,			283	500
† 3 Vessels	,,	,,		211ea	430ea
† 2 Vessels	,,	,,	,,	212ea	450ea
† British Empire ..	,,			278	500
† 2 Vessels	,,			2[illegible]3ea	500ea
† 2 Vessels	,,			240ea	450ea
† 133 & 134 ..	,,	,,	,,	180ea	300ea

THE THAMES, &c.

By Beeching Bros., Ltd., Gt. Yarmouth.

Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
* 6 Vessels	Wood	Steam	Native	65ea	170ea
m Pride	,,	,,	,,	91	240

By John Chambers, North Side Harbour, Lowestoft.

* Spray	Wood	Steam	Native	60	100
* Honeysuckle ..	,,	,,	,,	61	90
† Fancy and Enterprise ..	,,	,,	,,	83ea	200ea
* Tryphena ..	,,	,,	,,	68	120
* Boy Ben	,,	,,	,,	83	170
* Prolific	,,	,,	,,	60	90
* Superb	,,	,,	,,	80	170
Pet	,,	Sail	,,	55	—
† Caledonia ..	,,	Steam	,,	81	200
5 Trawling Smks	,,	Sail	,,	56ea	
† Racer	,,	Steam	,,	84	200
* Primrose	,,	,,	,,	87	170
† Sarepta	,,	,,	,,	88	200
* Boy Jacob ..	,,	,,	,,	61	100
† Helena	,,	,,	,,	87	200

† Triple. * Compound. *m* Motor.

By Edwards & Co., Ltd., Millwall, E.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis	I.H.P.
Dahlia	Steel	Barge	Native	98	—
557	,,	,,	,,	21	—
* 558	,,	Steam	Foreign	24	130
2 Barges		,,	,,	31ea	—
2		,,	,,	16ea	—
‡‡ Brazil ..		Steam	,,	354	290
‡‡ Emperor Menelik and Empress			Native	230ea	130ea
‡‡ Prince Regent ..			,,	52	230
‡‡ Lilias and Kathleen				593ea	320ea

By Fellows & Co., Ltd., Yarmouth.

* Monitor	Wood	Steam	Native	67	
* Celandine ..	,,	,,	,,	73	—
* Nelson	,,	,,	,,	70	—
* Brighton	,,		,,	74	—
* Meg	,,	,,	,,	82	—
* Lowestoft Bell	Steel	Steam	,,	50	

By Forrestt & Co., Ltd., Wyvenhoe.

2 Motor Pinnaces	Wood	Motor	H.M.Admty.	27	240br
* S. T. Cysne ..	Steel	Steam	British	71	125
Horse Flat ..	,,	—	H.M.Admty.	10	
6 Canoes			Crown Agents	40	—
* 2 Pinnaces ..	Wood	Steam	H.M.Admty.	30	400
* 3 Pinnaces ..	,,	,,	,,	37	390
m Motor Launch	Steel	Motor	Foreign	12	—
m Motor Launch	,,	,,	British	5	4½ B.H.P.
* Launch ..	Wood	Steam	,,	9	27
† Marquez de Fontes	Steel	,,	Foreign	104	250
† Tug	Wood	,,	British	250	700
m Launch	Steel	Motor	,,	8	15br
m Launch	Wood	,,	,,	4	14
m Launch	Steel	,,	Colonial	12	—
* Cochin	Wood	Steam	,,	10	60
m Cisne and Garza	,,	Motor	Foreign	13ea	65ea brake
Ferry Boat ..	Steel		,,	10	—
* 2 Sternwheel Steamers ..		Steam	British	88ea	350ea
2 Canoes		—	Crown Agents	8	—

By Gill & Son, Rochester.

Hydrogen [illegible] ..	Wood	Sail	English	—	

By R. & H. Green, Ltd., Blackwall, E.

2 Coal Barges	Steel	-	British	160ea	—

By H. Reynolds & Son, Lowestoft.

* 3 vessels	Wood	Steam	Native	74ea	120 ab ea
* 3 vessels	,,	,,	,,	76ea	120 ab ea
* Halcyon & Pearl	,,		,,	71ea	120 ab ea
* Prosperity and Welland ..	,,	,,	,,	72ea	120 ab ea
Enterprise ..			,,	77	120 ab ea
† Titania			,,	92	220 ab
Henry Charles ..		Sail	,,	52	Nil
Francis Robert	,,	,,	,,	55	,,

By A. W. Robertson & Co., Lea Shipbuilding Yard, Canning Town, E.

* 1 Twin-Screw Ferry Steamer	Steel	Steam	British	259	460
* 4 Screw Tugs ..	,,	,,	Foreign	100	300
3 Lighters	,,	,,	British	610	—
18 Lighters	,,	—	Foreign	3200	

* Compound. ‡‡ Compound Surface Condensing.
m Motor. † Triple.

By G. Rennie & Co., Thames Street, Greenwich.

Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
Purfleet	[illegible]	[illegible]	—	140	375
Virginia	[illegible]	-	-	124	370
Screw Steamer	—	[illegible]	—	73	160
.. .	[illegible]	—	—	23	80
.. ..	[illegible]	[illegible]	—	50	60
Screw Tunnel Launch ..	—	—	—	10	40
Dredger	[illegible]	[illegible]	-	275	220
2 Salvage Vessels ..	[illegible]	[illegible]	—	360ea	—
2 Hopper Barges	[illegible]	—	[illegible]	120ea	—
Grab Dredger ..	[illegible]	—	—	60	—
Bucket Dredger —	[illegible]	—	—	130	
6 Lighters ..	[illegible]	[illegible]	[illegible]	125ea	—
2 Lighters .. —	[illegible]	[illegible]	-	160ea	—
Water Barge ..	[illegible]	—	—	130	—
6 Lighters .. —	[illegible]	[illegible]	-	95ea	
2 Lighters ..	[illegible]	[illegible]	[illegible]	30ea	

By H. Shrubsall, East Greenwich, S.E.

Veronica	Wood	Sail	Native	69	

By John I. Thornycroft & Co., Ltd., Chiswick.

t Gadfly, Glow-worm & Gnat	Steel	Steam	British	227ea	3700 ea
m Boat 422	Wood	Motor	Portuguese	5	45 B.H.P.
m Spider and Sand-fly	Steel	,,	British	5ea	,,
f Boat 433	,,	Steam	,,	5	40
f Boat 440	,,	,,	,,	9	120

By The Thames Ironworks Shipbuilding and Engineering Co., Ltd., Blackwall.

* 8 Torpedo Vedette Boats	Steel	Steam	Roumanian Govt.	48ea	600
12 Barges	Steel and iron		For service on Thames	80ea	-
11 Lifeboats ..	Wood	Sail	Royal Nat. Lifeboat Inst.		

By Yarrow & Co., Ltd., Isle of Dogs, Poplar.

2 Twin-screw Torpedo Boat Destroyers, 220 ft. long by 20 ft. 6 ins. beam, speed carrying a load of 60 tons, 31·8	Foreign	270ea	7,500ea
24 Water Tube Boilers for H.M.S. Shannon	British	—	27,000
1 Torpedo Boat, 60 ft. long by 8 ft. 6 ins. beam, fitted with Internal Combustion Engines ..	,,	185	350
1 Twin-screw Shallow Draught Launch, 60 ft. long by 9 ft. 3 ins. beam, draught, 18 ins., speed, 13 miles	Foreign	17	30
5 Twin-screw Shallow Draught Launches, 85 ft. long by 16 ft. beam, draught, 12 ins., speed 11½ miles	,,	40ea	60ea
2 Single-screw Shallow Draught Launches, 75 ft. long by 9 ft. 3 ins. beam, draught, 15 ins., speed, 11½ miles	,,	21ea	30ea
2 Shallow Draught Single-screw Launches, 85 ft. long by 12 ft. beam, draught, 11 inches, speed 10½ miles	,,	42ea	60ea
1 Motor Launch, 60 ft. long by 7 ft. beam, fitted with internal combustion engines	,,	6	60
1 Launch, 60 ft. long, fitted with internal combustion engines	,,	14	130

t Turbine. *m* Motor. *f* Compound Non-Condensing.
* Compound.

ENGLISH CHANNEL.

By Camper & Nicholson, Ltd., Gosport.

Name of Vessel	Built of	Class.	Owners	G.T Regis	I H P
Nyria	Compos.	Sail	Native	81	—
Yazeka	Wood	Motor	,,	27	80
Thetis		Sail	,,	7	
Launches		Motor	,,	5	87

By J. & H. Cann, Harwich.

Edith May ..	Wood	Sail	Native	78	-

By R. Cock & Sons, Quay, Appledore, R.S.O.

6 Barges	Steel		Native	70ea	-
6 ,, ...	Wood		,,	20ea	-
Geisha	Wood	Sail	,,	130	
Lucy Johns ..	Steel	Sail	,,	144	—
Primrose	,,	Steam	,,	53	—
4 Barges	..	—	,,	40ea	—
4 ,, ...	Wood		,,	40ea	—

By Cox & Co., Falmouth.

* Tug		Steam	British	—	240
* Yacht		,,	,,	-	110
† 2 Vessels		,,	,,	—	570ea
* Tug .. .. .. —		,,	,,	—	312

By Hartley Mead, East Cowes.

m 7 Launches ..	Wood	—	British	20	50

By H. S. Hansen & Co., Minerva Yard, East Cowes.

m Suzanne	Compo.	—	American	75Bab	-
6, 56 ft. Admiralty Steam Pinnaces ..	Wood	Steam	B. Navy	200 ab ea	—

By J. & W. B. Harvey, Littlehampton.

Leading Light .	Wood	Sail	Native	114	—
Swift	,,	Motor	Native	—	—

By G. Napier & Son, Cross House Engineering Works, Southampton.

* Rene	Steel	Steam	British	15	35

By Philip & Son, Ltd., Dartmouth.

‡‡ Diego Martinez .	Steel	Steam	Foreign	120	200
m Dwynwen ..	Compos.	Sail	British	100	70
‡‡ Queen	Steel	Steam	,,	80	160
Hopper barge ..	Wood	—	,,	40	—
‡‡ Admiralty launch	Steel	Steam	,,	40	120
‡‡ 2 ,,	Wood	,,	,,	35ea	90ea
‡‡ Sea Flower ..	Steel	,,	,,	90	170
‡‡ Viking	Wood	,,	Foreign	30	80
† Kalika	Steel	,,	British	250	550
Several small boats, Wood, Steam and Sail, British and Foreign				45	65

By Geo. & Thos. Smith, Ltd., Rye, Sussex.

No. 12	Wood	Sail	British	60D.W.	—
Dayspring ..	,,	,,	,,	22	—
3 Trawlers	..	..	..	50ea	

By H. R. Stevens, Ltd., West Quay, Southampton.

m Wanderer and Mercurio ..	Wood	·	Native	—	
m Dixaldy	,,	—	Foreign		-
m 20′ Launch			..		

By John I. Thornycroft & Co., Ltd., Woolston Works, Southampton.

Princess Royal	—	Steam	British	428	1,500
Hornbill		..	Nigeria	76	100
7 Ferry Steamers	—	..	Calcutta	840	3,500
t 4 sets of Machinery for Coastal Destroyers ..	—	..	British Admiralty		14,000

* Compound. † Triple. *m* Motor. ‡‡ Compound Surface Condensing. *t* Turbine.

By Simpson Strickland & Co., Ltd., Dartmouth, Devon.

	Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
a	Rose en Soleil	Steel	Steam	British	5	220
m	No. 626	Wood	—	,,	2	
a	No. 639		Steam	Foreign	2	14
*	Alert			British	25	100
m	No. 651		—	,,		—
*	Nos. 652, 653, 656, & 657		Steam		12ea	100ea
*	Nos. 654 & 655			,,	11ea	100ea
a	Nos. 658 & 659		,,	,,	36a	14ea
m	No. 660	Steel	—	,,	2	
*	No. 8	Compos.	Steam	Foreign	47	200
a	Shark	Wood		,,	11	27
†	No. 663				5	48
*	No. 664				4	11
a	No. 665			British	2	10
	Machinery only		–		—	467
	Boilers		–		—	230

By White Bros., Southampton.

m	Elizabeth	Wood	—	Foreign	236ym	—
m	Ione			British	7ym	—
m	Covenhoven	,,	—	,,	10ym	—
m	T.S. Launch		–		10ym	–

By J. Samuel White & Co., Ltd., East Cowes.

t	Cricket, Dragonfly, Firefly, Sandfly and Spider	Steel	Steam	British Admiralty	300ea	4,000ea
*	Drin	Steel	Steam	Foreign	25	90
*	America	Wood	,,	Native	15	30
*	Also 23 Launches of various sizes	,,	,,	British Admiralty	300 Total	3,150 Total
*	2 Launches	,,	,,	Foreign	25	75

By Wm. White & Sons, Cowes.

*	2 Launches	Wood	Steam	Native	25ea	70ea
*	Pinnace	,,	,,	,,	20	80
*	Launch	,,	,,	,,	8	30
*	Launch			Foreign	6	22
*	Launch				7	28
*	Machinery for Launch			Native		22
	2 Boilers					

By Willoughby Bros., Ltd., Plymouth.

*	Jeton Castle	Steel	Steam	Native	32	

THE MERSEY, &c.

By The Caledonian Engineering & Shipbuilding Co., Preston.

	Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
*	Manhiny	Steel	Steam	Foreign	151	280
*	Liverpool			British	480	800
*	Marcilio Dias			Foreign	1885	2800
†	No. 105				900	7500

By Cammell, Laird & Co., Ltd., Birkenhead.

t†	St. George	Steel	Steam	British	2,450	6,000
†	Portia				432	75
	Alexandra and Nelson				877ea	
t†	Marylebone				1,972	6,000
	Canada and Sandon				870ea	
*	W. E. Dorrington	,,	,,	,,	175	550

By T. Summers & Sons, Liverpool.

*	Leopoldo Bulhoes	Steel	Steam	Foreign	31	85
	No. 1 41 Barge		–		85	

a Quadruple. *m* Motor. * Compound. † Triple.
t Turbine. *t*† Turbine Triple.

By Isaac Pimblott & Sons, London Road, Northwich.

	Name of Vessel.	Built of	Class	Owners.	G.T. Regis	I.H.P.
	3 Lighters	Steel	Sail	Native	70ea	—
	2 ,,				97ea	
	3 Launches		Steam		6ea	22ea
*	Castor				52	120
,	Grab Barge		Sail		21	—
	5 Lighters				40ea	–
*	Luz II.	,,	Steam		63	130

By D. Williams, Portmadoc.

	John Pritchard	Wood	Sail	Native	118	

By R. Williamson & Son, Workington.

†	Voreda	Steel	Steam	Native	679	—
†	Colwith Force				550	
*	Balava				400	
	Barges		—		1,270	—

By Wm. J. Yarwood, Castle Dock, Northwich.

	3 Barges	Steel	—	Native	60ea	—
‡‡	Crusader		Steam		144	100
‡‡	Trevor and Constance				250ea	225ea
‡‡	Brenda				123	160
	No. 67 & 68 Pontoons	Wood			—	
‡‡	The Tan	Steel	Steam	Foreign	10	20
	Nina and Nanny	Compos.	Barge	Native	100ea	—
	3 Barges	Compos.	—	,,	60ea	—

By Vickers, Sons & Maxim, Ltd., Naval Construction Works, Barrow-in-Furness.

Rurik	Armoured Cruiser, built for the Imperial Russian Government.
Almirante Grau	Protected Cruiser, built for the Government of Peru.
Coronel Bolognesi	Protected Cruiser, built for the Government of Peru.
Lady Grey	Ice Breaking Steamer built for the Canadian Government.
Dreadnought & other Ships	Machinery only British Government.
	Total tonnage 26,770
	Total Indicated Horse Power 79,000

BRISTOL CHANNEL, &c.

By Isaac J. Abdela & Mitchell, Ltd., Brimscombe, Stroud.

	Name of Vessel.	Built of	Class	Owners.	G.T. Regis.	I.H.P.
	Pavilima	Steel	Barge	Foreign	12	—
*	2 Vessels		Steam		80a	45ea
*	San Juan				38	260
	Salamander			English	19	—
	D'Angela			Foreign	3	16
*	Ibex			English	7	75
	Pajuva		Barge	Foreign	24	
	Hidalgo				52	–
	Ines	,,			10	—
	3 Vessels		Steam		30a	250a
	Sepahna		Barge		3	
††	Amerigo				8	80
†	Conto II.				14	65
	Surfboat		Steel	Foreign	2	
	4 Galvd. Steel Dinghys		Steel			

* Compound. † Triple. ‡‡ Compound Surface Condensing.
†† Twin Compound

C. H. Walker & Co., Ltd., Sudbrook, Chepstow, Mon.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
		Towing			shipped
No. 132	Steel	Barge	Native	243	in pieces
No. 137		Sand Pump Barge		80	
† Hopper No. 1 ..		Steam		434	400
2 Towing Barges ..		—		236ea	—
Nos. 22/4.. ..		Square section		143ea	shipped in pieces
Nos. 25/6.. ..				186 ,,	
Nos. 27/30				143 ,,	
Nos. 31/6..				224 ,,	
No. 37				158	
Nos. 38/9.. ..				224	
No. 40				158	
No. 41				210	

THE RIBBLE.

By The Lytham Shipbuilding and Engineering Co., Ltd., Lytham, Lancs.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
* Kingsway .	Steel	Steam	British	240	475
* Dragon .				20	40
* Portador ..				95	110
† Stern Wheel Steamer			Foreign	40	40
† Stern Wheel Steamer				47	90
* Lowgarth .			British	74	375
* Anastasio			Foreign	315	250
* Pacifico				75	35
* Argus .. .			British	60	175
* Miraflores			Foreign	135	35
6 Lighters ..		Sail		1,200	

ROYAL DOCKYARDS.

By H.M. Dockyard, Portsmouth.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
*‡ H.M.S. Dreadnought	Steel	Steam	British battleship	—	23,000

By H.M. Dockyard, Chatham.

† Shannon .. .	Steel	Steam	British Govt.		16,000

By H.M. Dockyard, Devonport.

* Minotaur .	Steel	Steam	British Govt.	—	19,000

LIST OF VESSELS ENGINED IN 1906.

By Amos & Smith, Hull.

Name of Vessel	Builders	I.H.P.	Press. lbs.
* 1 Vessel	Cook Welton & Gemmell	280ea	200ea
* King Edward and Cæsar	Earles Shipbuilding Co.	7800ea	180ea
* Regal	Cook Welton & Gemmell	440	180
* 2 Vessels		560	200ea
† 5 ,, ...	,, ,,	280ea	200ea
* 2	Cochrane & Sons	1250ea	180ea
* No. 1153	Ewart	450	200
* Bertha	Earles Shipbuilding Co.	700	200
* 2 Vessels	Cochrane & Sons	560	200ea
* 4	Ewart	560	200ea
* 3		840	200ea
* 1 Vessel		700	200

Total .. 13,700

* Triple-Expansion † Triple-Compound ‡ Quadruple-Expansion § Compound

By Baird Bros., North Shields.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
* Nos. 783, 784, 785 and 790	Steel	Armstrong Whitworth and Co. Ltd. .. .		130ea	120ea
			Total ..	520	

By Blair & Co., Ltd., Stockton-on-Tees.

* Samara	William Gray & Co., West Hartlepool ..	1,450	—	
* Foston, Upcerne and Ethyl ..	Ropner & Son Stockton-on-Tees	1,450ea	—	
* Medomsley ..	Blyth Shipbuilding Co., Ltd. Blyth	500	—	
* Martazan	R. Craggs & Sons Ltd. Middlesbro'	1,050		
* Achlibster	Richardson, Duck & Co. Stockton	1,900	—	
* King Edward and Ethelwolf	Robt. Stephenson & Co. Hebburn	1,800ea	—	
* Evelyn and Maude	Irvines S.B. Co., Ltd., West Hartlepool ..	1,050ea	—	
* Chatham	Armstrong Whitworth & Co. Low Walker ..	2,200	—	
* Don Arturo and King David	Craig Taylor & Co., Ltd., Thornaby	1,750ea	—	
* Trafalgar	John Crown & Son, Sunderland	1,150	—	
* Pola	Richardson Duck & Co., Stockton	1,450	—	
* Tiverton	Robt. Stephenson & Co. Ltd. Hebburn	1,750	—	
* T.C.C. Hopper, No. 3	Ropner & Son, Stockton-on-Tees	600	—	
* Don Benito ..	Short Bros. Ltd., Sunderland	1,700	—	
* Thirlwall	Richardson Duck & Co., Stockton	1,450	—	
* Tricolor	Tyne Iron Shipbuilding Co. Willington	1,850	—	
* Parkgate	R. Craggs & Sons, Ltd., Middlesbrough	1,450	—	
* Rollesby	Ropner & Son, Stockton-on-Tees	1,850	—	
* Don Caesar ..	Jos. L. Thompson & Sons, Sunderland	1,700	—	
* Patagonia	Richardson Duck & Co., Stockton	1,450	—	
* Fimroite	R. Craggs & Sons, Ltd., Middlesbrough	1,750	—	
* Antaeus	Ropner & Son, Stockton-on-Tees	1,500	—	
* Maltby		1,850	—	
* Picton	Richardson Duck & Co., Stockton	1,450	—	
* King George ..	R. Craggs & Sons Ltd. Middlesbrough	1,750	—	
* Diadem	Richardson Duck & Co., Stockton	1,750	—	
* King John ..	Jos. L. Thompson & Sons Sunderland	1,750	—	
* Tottwood	R. Craggs & Sons Ltd. Middlesbrough	1,450	—	
* Millpool .. .	Ropner & Son, Stockton-on-Tees	1,900	—	
* Blackfriargate ..	,,	1,400	—	
* Heatlands ..	Richardson Duck & Co. Stockton	1,050	—	
* Don Emilio and King Lud ..	Jos. L. Thompson & Sons Sunderland	1,700ea	—	
* Helredale	R. Craggs & Sons Ltd. Middlesbrough	1,700		
* Camphill	Ropner & Son, Stockton-on-Tees	1,850	—	
		2 Vessels ..	3,400	

* Compound † Triple

By Central Marine Engine Works, West Hartlepool.

Name of Vessel.	Port of Registry.	I.H.P.	
Harperley and Harlyn	London	2,000ea	
Monaro	Melbourne	1,250	—
Rubens	London	1,700	-
Marchioness of Bute and Llanwern	Cardiff	2,000ea	—
Trinity	Leith	2,000	-
Harewood, Antiope and Cresswell	London	1,500ea	—
Buxton	Hull	1,500	
Aagot	Bergen	1,700	
Dan and Uffe	Copenhagen	1,100ea	—
Stegelborg	,,	1,000	—
Mathilda	Bergen	2,000	-
Alexandra	Hartlepool	1,500	—
Skogland	Helsingborg	1,700	
Ben Lomond	Newcastle	1,500	—
Tangistan	Swansea	1,700	--
Headley	London	2,300	--
Ravelston	Grangemouth	1,200	-
Veraston	West Hartlepool	1,000	
Dirphys	Athens	1,500	—
	Total	38,250	

By George Clark, Ltd., Sunderland.

SS.'s Brook, Shira, Kildale, Saint Patrick, Duendes, Esmeraldas, Flamonco, Alconda, Roma, Berlin, Pathfinder, Prudence, Andriana, Lady Cora Wright, Pelham, England, La Blanca, Hornelen, Hampshire, Tosto, Cedargrove, Paralos, Skipton Castle, El Argentino and Re d'Italia. Total, 25 engines; nominal horse power by Lloyds' rules, 8,551; estimated indicated horse power, 51,500.

By Crabtree & Co., Great Yarmouth.

	Name of Vessel	Builders	I.H.P.	Press. lbs.
	River Boat	Fellows & Co., Ltd.	120	120
*	2 Drifters	,,	300	130
*	1 ,,	,,	175	130
*	1 ,,	,,	100	140
*	4 ,,	Beeching Bros., Ltd.	700	140
*	1 ,,	,,	175	140
*	1 ,,	Jonker & Stans	220	120
*	Hopper Barge	,,	400	130
*	Tug	Gaston Graving Dock & Ship Co.	100	120
*	Tug & Tender	,, ,,	650	180
*	Trawler	Goole Ship. Co.	500	180
*	Drifter	Sanders & Co.	100	130
*	,,	H. Reynolds & Sons	160	140
*	,,	,, ,,	175	140
*	2 Drifters	Crabtree & Co.	380	140
*	Cargo Steamer	Montrose Shipbuilding Co.	220	120
*	Fishing Vessel	French Builders	300	130
*	— — —	Export	300	130
*	— — —		60	120
	— — —		75	—
*	4 Engines		260	—
	— — —		300	180
*	2 ,,	Rennie & Co.	240	—
*	1 ,,	Myers Ship Co.	200	140
*	1 ,,	Miscellaneous	135	150
		,,	160	150
		Total	6,745	

By Davis & Co., Ltd., Lowestoft.

*	Luz II.	Messrs. Pemblott	110	130
	El Nato	Messrs. Warren	95	125
	El Tomto de la Boca	Messrs. Warren	85	125
*	Aurora	Messrs. H. Reynolds	136	140
		Total	426	

* Compound. † Triple. ‡ High Pressure.
ƒ Compound Non-Condensing.

By John Dickinson & Sons, Ltd., Palmers Hill Engine Works, Sunderland.

A list of the vessels for which they have built engines and boilers, *viz.*:—SS.'s Dacre Hill, Charlton, Olivemoor, Goathland, Finn, Carl, Ragnar, Gorsefield, Waltham, Gjöa, Thistlemor, Ludgate, Rochdale, Times, Aldersgate, Aboukir, Riversdale, Skogstad, Haydn, South Wales, Wearbeck, St Paul, Sheaf Field, Bangarth, O. A. Knudsen, Ennisbrook, Towergate, Glamorgan, Tudhoe and No. 205 B.S.; total, 30 vessels; the total Lloyds' nominal horse power is 8,517; in addition to the above, they have built 11 extra boilers.

By Elliot & Garrood, Ltd., Beccles.

	Name of Vessel.	Builders.	I.H.P.	Press. lbs.
*	3 Vessels	Jno. Chambers, Lowestoft	90ea	130ea
†	Havsulen of Norway	(not known) Norwegian built	30	160
*	3 Vessels	Jno. Chambers, Lowestoft	100ea	130ea
†	6 Vessels	,, ,,	200ea	175ea
*	White Heather, B.F.	Kitto & Son, Porthleven (Cornwall)	90	130
*	3 Vessels	H. Reynolds, Oulton Broad, Lowestoft	170ea	140ea
*	3 Vessels	Jno. Chambers, Lowestoft	170ea	140ea
†	Titania, B.F.	H. Reynolds, Oulton Brd	200	175
		Total	3,110	

By Great Central Co-operation, Co., Ltd., Grimsby.

*	Anacoona	Goole Shipbuilding Co.	480	180
†	Aries, Lynx and Helcia	Cochrane & Sons, Selby	480ea	180ea
†	Nora Niven	,, ,,	250	180
		Total	2,170	

By G. T. Grey, Holborn Engineering Works, South Shields.

**	Trompenberg	A. Vuijk & Sons, Holland	900	
*	Swale	J. J. Croles, Holland	370	
**	3 Trawlers	Goole Shipbuilding Co.	390ea	
*	Lilian	,, ,,	430	
**	Borcas & Nicholas	Van Vliet & Co., Holland	450ea	—
**	Peter Maersk	A. Vuijk & Sons, Holland	800	
**	Fagersand	,, ,,	960	-
**	Braconheath	J. T. Eltringham & Co.	370	—
**	St. George	,, ,,	450	—
††	Carog Steamer	T. Dobson & Co., Hessle	600	
		Total	6,950	

By Hepple & Co., Ltd., South Shields.

††	Hopper No. 4	J. T. Eltringham & Co.	600	130
†	Bertha	Hepple & Co., Ltd.	420	180
*	Laura	,, ,,	120	100
*	Prompt	,, ,,	300	130
*	Artificer	,, ,,	350	130
		Total	1,790	

By C. D. Holmes & Co., Hull.

†	5 Vessels	Messrs. Cook, Welton & Gemmell, Ltd., Beverley	450ea	180ea
†	5 Vessels	,,	430ea	180ea
†	3 Vessels	,,	450ea	200ea
†	Quail and Grebe	,,	500ea	180ea
†	British Empire	,,	500	200
†	Eske	Messrs. Cochrane & Sons, Selby	570	200
†	12 Vessels	,,	450ea	180ea
†	8 Vessels	,,	450ea	180ea
†	Earl Monmouth	,,	450	200
		Total	17,110	

* Compound. † Triple. ** Triple Compound.
†† Twin Compound.

By T. & J. Hosking, Bermondsey.

	Name of Vessel.	Port of Registry.	I.H.P.	Press lbs.
*	Foreign		140	140
*	,, ...		300	120
*	,, ...		120	120
*	,, ...		80	120
*	British		60	120
*	,, ...		75	160
*	,, ...		320	130
*	,, ...		60	160
*	Foreign		80	130
*	,, ...		200	160
*	,, ...		75	125
		Total ..	1,510	

By MacColl & Pollock, Ltd., Wreath Quay Engineering Works, Sunderland.

Adventure ..	St. John's, Newfoundland	2,100	180
Portia	Liverpool	607	130
Winona	Hamilton, Ontario ..	1,140	180
Rawcliffe	Goole	770	180
Klio	Bremen	880	180
Taarnborg ..	Kobenhaven	850	180
India, Persia, Arabia, Dragon and Hydra ..	London	450ea	180ea
Orland	Sandefjord	1,030	180
Libertad	Bahia Blanca	760	180
Pennard Castle	Swansea	470	180
S.S. No. 242 ..		600	130
	Total ..	11,457	

By North-Eastern Marine Engineering Co., Ltd., Wallsend and Sunderland.

Antar	London	1,900	—
Alster	Hamburg	2,200	—
Amelia & Bella .	Bristol	1,000ea	—
Ariel	Holmestrand	1,100	–
a Argo Bolivian	London	3,500	—
Antigone	London	1,455	
Austa	Copenhagen	787	—
Asiatic	Hull	1,870	–
Arnold .. .	Whitby	1,870	—
Barnby .. .	Whitby	2,174	–
Borgestad	Porsgrund	2,567	
Belle of Ireland .	Liverpool	2,300	—
Bendu	Liverpool	2,400	—
Birtley	Newcastle	1,050	-
Cuthbert	Liverpool	3,000	
Comtesse de Flandre	Antwerp	1,700	—
Cygnus	Christiania	950	—
Cliftonhall ..	W. Hartlepool	1,950	—
a Clupane	London	3,500	
Coromilla	Newcastle	850	—
Croxdale	W. Hartlepool	901	
City of Cardiff ..	Cardiff	1,750	-
Cambria	Hull	1,870	-
Djerv	Antwerp	1,000	—
Enosis	London	1,950	—
Edelman .. .	Cardiff	1,800	
Edmonton ..	Toronto	1,100	–
Fritzoe & Fornebo	Christiania	2,500ea	–
Flaval .. .	Hull	1,930	
Foxlea .	London	2,300	–
Goliath .	Rangoon	500	—
Henri Gerlinger	Antwerp	817	
Hollywood ..	London	1,310	—
Hallelujah & Magnum .	Copenhagen	880ea	-
Herald. Ibsen	Bergen	2,000	—
Hesden	Newcastle	1,050	—
Inverkyle & Largo Law	London	2,750ea	—

* Compound. *a* Quadruple.

The North-Eastern Marine Engineering Co., Ltd.—*contd*

Name of Vessel.	Port of Register.	I.H.P.	Press lbs
John O. Scott .	Newcastle	1,000	—
Kossuth	Budapest	2,000	—
Karnak	Liverpool	1,990	—
Kaiapoi	Dunedin	1,192	–
King Frederick .	London	1,942	
Lusitania (twin screw)	Lisbon	5,000	-
Leopold II. ..	Antwerp	1,950	
Lady Furness & Vera	Copenhagen	950ea	—
Mostar	Trieste	817	
Marstonmoor ..	London	1,598	—
Manica	Lisbon	721	—
Marlwood ..	London	1,192	
Okehampton ..	Cardiff	1,950	—
Polyphemus ..	Liverpool	3,100	-
Republic	Hull	2,146	—
Serak	Hamburg	3,000	
St. Andrews ..	Cardiff	2,092	—
Trader	London	2,092	–
Trym	Tonsberg	1,230	—
Unita	Sandefjord	2,300	—
Greve	Amsterdam	1,650	—
C. 1687	.. .. ..	2,900	—
Huguenot ..	Newcastle (re-boilered) .	800	—
Ibex	London ,,	1,650	—
Douro	Sunderland ,,	450	—
Maria Regier ..	Odessa ,,	414	-
	Total ..	120,854	

By Parsons Marine Steam Turbine Co., Ltd., Turbinia Works, Wallsend.

	Name of Vessel.	Builders.	I.H.P.	Press. lbs
t	H.M.S. Dreadnought	H.M. Dockyard, Portsmouth		—
t	H.M.S. Gadfly ..	J. I. Thornycroft & Co., Ltd.		–
t	Torpedo-boat Destroyer ..	Palmers Shipbuilding & Iron Co., Ltd.	—	—
t	Torpedo boat Destroyer ..	..	—	–
		Total ..	43,000	

By Plenty & Son, Ltd., Newbury.

*	20 Foreign ..	T	3,150	120
*	10 Home	T —		
†	2 Home	T		
†	1 for India ..	T —	1,700	165
†	1 for Austria ..	T		
	Total		4,856	

By David Rollo & Sons, Fulton Engine Works, Liverpool.

†	Iris and Daffodil	R. Stephenson & Co., Ltd., Hebburn-on-Tyne	1,500ea	180ea
†	Vito, new Triple engines and boilers	,,	750	180
*	Wallasey, new boilers and ship alterations ..	,,	500	80
†	S.S. Duke of Gordon, new D.E. boilers	,,	1,700	150
	Mersey Dock and Harbour Board 3 new boilers	,,	1,500	130
	Do., do., 1 new boiler ..	..	400	180
	Total		7,850	

t Turbine. * Compound. † Triple.

By Richardsons, Westgarth & Co., Ltd., Hartlepool, &c.

S.S. Roanoke, 2,200; S.S.'s Midgard, Century, Purley, Balaclava, Bramley, Asgard, Wangard and Utgard, 2,000 each; S.S.'s Harley and Period, 1,800 each; S.S. Clivegrove, 1,750; S.S.'s Sommerstad, Coaling, Bessborough, Malvern Range, Heathpool, Lowther Range, Ada, Dipton, Harpenden, Elloe and Corunna, 1,700 each; S.S.'s Gutrune, Gunther and No. 156, 1,550 each; S.S. s Ribston, Snowdon Range, Ripon, Linda Fell, Myra Fell and No. 305, 1,500 each; S.S. Thordis, 1,400; S.S. Bertha, 1,350; S.S. Parkwood, 1,200; S S. Malinche, 1,050; S.S Randulf Hansen, 950; S.S's. Virgo and Faithful, 900 each; S.S. King Edward, 850; S.S. Vega, 800; total I.H.P for year, 65,300.

By Shields Engineering & Dry Dock Co., Ltd., North Shields.

	Name of Vessel	Builders	I.H.P.	Press. lbs.
†	5 Vessels	Smiths Dock Co. Ltd.	500ea	180ea
†	Annie Melling	"	475	180
†	2 Vessels	"	550ea	180ea
†	4 Vessels	"	480ea	180ea
†	Mary	Dundee Shipbuilding Co.	475	180
†	Lord Nelson	Smith's Dock Co., Ltd.	540	180
†	Saxon Prince	J. T. Eltringham & Co.	475	180
		Total	7,485	

By W. Sisson & Co., Gloucester.

†	Shamrock	Not known, Windermere	30	200
*	May	" owner.	7	110
*	Primrose	R. Cock & Sons, Appledore	180	110
*	Not known	Saunders Patent Launch Building Synd. Ltd., Cowes	75	165
		Total	292	

By Thames Engineering Works, Greenwich, S.E.

†	H.M.S. Black Prince	Thames Ironworks Shipbuilding and Engineering Co., Ltd., Engineering Dept., Greenwich, S.E.	23,500	210
*	8 Torpedo Vedette Boats for Roumanian Government		600	180
		Total	24,100	

By J. S. Vaux & Co., Sunderland.

*	2 Sets	Shipped abroad	500	

By Vauxhall Iron Works Co., Ltd., Luton.

‡‡	Brazil	Edwards & Co.	290	
‡‡	2 Vessels	"	120ea	
‡‡	Prince Regent	"	270	—
‡‡	Shipped abroad	Alley, Maclellan & Co.	150	—
‡‡	Castor	"	150	—
‡‡	Shipped abroad	Alley, Maclellan & Co.	285	—
‡‡	Lilias & Kathleen	Edwards & Co.	600ea	—
‡‡	4 Sets	Shipped abroad	415	—
		Total	3,000	

By The Wallsend Slipway & Engineering Co., Ltd.

Denewell	Tyne Iron S.B. Co., Ltd.	1,650	—
Salatis	Sir W. G. Armstrong, Whitworth & Co., Ltd.	2,900	
Osmanieh	Swan, Hunter & Wigham Richardson, Ltd.	6,800	—
Holger	"	3,600	
Hermione	Sir W. G. Armstrong, Whitworth & Co., Ltd.	2,600	—

† Triple. * Compound. ‡‡ Compound Surface Condensing.

	Name of Vessel	Builders	I.H.P.	Press lbs.
	Aydon	Swan, Hunter & Wigham Richardson, Ltd.	1,700	
t	Immingham	"	7,000	
	Sandon Hall	"	2,750	
	Sakkarah	Sir W. G. Armstrong, Whitworth & Co., Ltd.	3,000	—
	Charcas	"	3,500	
	San Christobel	"	1,350	
	Arawa	Swan, Hunter & Wigham Richardson, Ltd.	5,650	
t	Mauretania	"	70,000	
	Sisak	Sir W. G. Armstrong, Whitworth & Co., Ltd.	3,000	
		Total	115,500	

SCOTCH.

THE CLYDE, &c.

By Abercorn Shipbuilding Co., Paisley, N.B.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
Floating Ship	Shape	Caisson	Foreign	733	—

By Ailsa Shipbuilding Co., Ltd., Troon and Ayr, Ayrshire.

†	Glenravel	Steel	Screw	Native	1,091	1,000
*	Sheila	"	"	"	454	500
*	Arethusa	"	"	"	477	370
*	Wheatear	"	"	"	379	600
*	Wheatsheaf	"	"	"	452	600
†	Jequitinhonha	"	Twin screw	Foreign	750	1,100
†	Commandatuba	"	"	"	751	1,100
†	Marahú	"	"	"	746	1,100
*	Retriever	"	Screw	Native	483	650
*	Jaguaripe	"	Paddle	Foreign	185	280
*	Sergy	"	"	"	184	280
	Red Riding Hood	Wood	Aux. motor	Native	13	17 bhp
*	Ailsa	Steel	Screw	"	60	150
*	Ailsa Craig	"	"	"	641	750
*	Kelpie	"	"	"	612	750
†	Mercury	"	"	"	531	700
*	Woolburn	"	"	"	170	250
	2 Passenger Barges	"	"	Foreign	200	
	2 Stern Wheelers	"	Steam	"	174	
	10 Barges	"	—	"	1,000	
	1 Barge	Wood		"	15	—

By Alley & MacLellan, Ltd., Sentinel Works, Polmadie, Glasgow.

5 Vessels	—	—	Foreign	990	1,520
2 Vessels	—	—	"	66	160
5 Barges	—			320	—

By Ardrossan Dry Dock and Shipbuilding Co., Ltd., Ardrossan.

3 V.Y.C. No. 3	Steel	—	British	100ea	
Tug (shipped)	"	Steam	Foreign	100	
* Brookfield	"	"	British	250	
* Resolute	"	"	"	203	
* Neyland	"	"	"	220	

By Barclay, Curle & Co., Ltd., Whiteinch, Glasgow.

Chupra	—	Steam	British	6,470	4,800
City of Carthage	"	"	"	5,625	3,310
Oriana	—	"	"	8,066	8,500
Denbigh Hall	—	"	"	5,134	2,700
Castalia	—	"	"	6,488	4,6[illegible]
Zealand	"	"	"	1,825	1,400

t Turbine. † Triple. * Compound.

By Wm. Beardmore & Co., Ltd., Naval Construction Works, Dalmuir.

Name of Vessel	Builders	I H P	Press lbs
H.M.S. Agamemnon First-class Battleship ..	British Government ..	16,550	16,750
T.S.S. Quillota ..	Pacific Steam Navigation Company	4,500	4,000

By Bow, McLachlan & Co., Ltd., Paisley.

Name of Vessel	Built of	Class.	Owners	G T Regis	I H P
Mazaffarpur ..	—	Steam	Colonial	524	950
Bolivia & Brazil .	—	,,	Foreign	729ea	930ea
Cormorant and Sentinel ..	—	,,	British	469ea	550ea
Chancay	—	,,	Foreign	234	290
Peru		..	..	729	930
12 Lighters ..		Sail	..	1,776	—

By G. Brown & Co., Ltd., Greenock.

Lady Elsie ..	Steel	Steam	Native	94	
Misrif Sabah ..	,,	,,	Colonial	130	
Samdad	..	..	Foreign	92	—
Yelcho	,,	,,	,,	219	
2 Steam Launches	,,	,,	Colonial	75ea	
Bull	..	..	..	470	—

By John Brown & Co., Ltd., Clydebank.

t† Atalanta	—	Steam	British	486	1,700
ta Lusitania	—	,,	,,	33,000 (Est.)	70,000
t† St. David ..		..	..	2,387	11,500
t† St. Patrick ..	—	,,	,,	2,387	11,500
Woodcock ..		..	..	1,523	3,500
Partridge	—	,,	,,	1,523	3,500
Northbrook ..	—	,,	Colonial	5,081	7,200

By Caird & Co., Ltd., Greenock.

a Nile	Steel	Steam	British	6,694	4,250
a Namur	,,	,,	,,	6,694	4,250
a Nyanza	..	..	..	6,695	4,250
a Nore	,,	,,	,,	6,695	4,250

By The Campbeltown Shipbuilding Co., Ltd., Campbeltown.

† Cambro	Steel	Steam	British	1,917	
† Apolla	,,	,,	,,	1,870	
m Genesta	Wood	—	..	15	

By W. Chalmers & Co., Rutherglen.

† Douglas II. ..	Steel	Steam	British	116	350
1 vessel (barge) .	,,	—	Foreign	75	
,, ,, .	.	..		42	
* Chucha	,,	Steam	,,	99	380
Sarita	,,	Sail	,,	380	
1 vessel (house boat)			..	50	—

By Clyde Shipbuilding & Engineering Co., Ltd., Port Glasgow.

Kurdistan ..	—	Steam	British	2,813	2,300
Rosebank ..		..	..	822	700
Shahristan ..		..	..	2,811	2,300
Soutra	—	,,	,,	2,740	1,500
Monksgarth ..		..	.	1,910	1,500
Singapore, Eng. & Boiler only			,,	—	2,500

By Charles Connell & Co, Ltd., Scotstoun.

Kilkerran ..	—	Steam	British	3,756	1,850
Ganges	—	,,	,,	3,475	2,500
Candidate ..			,,	4,521	2,700
Commodore ..	—	,,	,,	4,521	2,700
Inverclyde ..	—	,,	,,	4,995	2,250
Frankdale ..	—	,,	,,	4,836	2,250
Valbanera ..	—	,,	Portuguese	4,999	2,775

t† Turbine Triple. *ta* Turbine Quadruple. *a* Quadruple.
† Triple. *m* Motor. * Compound.

By D. M. Cumming, Blackhill Dock, Glasgow.

Name of Vessel	Built of	Class	Owners	G.T Regis	I H P
6 Barges	Steel	Sail	Foreign	90ea	.
* Tug	Compos.	Steam	,,	34	140
* 2 Tugs	,,	,,	,,	15ea	65ea

By Wm. Denny & Brothers, Leven Ship Yard, Dumbarton.

t Rewa	British India Steam Nav. Co., Ltd.	7,003	—
Asuncion	The Navegacion a Vapor Nicolas Mihanovich ..	738	—
Orari	New Zealand Shipping Co., Ltd.	7,207	—
t Duchess of Argyll	Caledonian Steam Packet Co.	583	—
Kingfisher ..	General Steam Navigation Co., Ltd.	871	—
Corumba	The Navegacion a Vapor Nicolas Mihanovich ..	738	—
Ava	P. Henderson & Co. ..	5,076	—
Opawa	New Zealand Shipping Co., Ltd.	7,230	—
Europa	The Navegacion a Vapor Nicolas Mihanovich ..	835	
Asia	,,	835	—
Africa	,,	833	—
Culna	British India Steam Nav. Co., Ltd.	6,019	—
Shipped abroad		2,664	

By David J. Dunlop, & Co., Inch Works, Port-Glasgow.

Ngatiawa	—	—	British	452	510
Atua	—		,,	3,444	3,885
Brundah			..	884	1,255
Alava II., ..			Foreign	1,154	1,220
Oshogbo			..	950	1,000

By R Duncan & Co., Ltd., Port Glasgow

† Strathairly ..	Steel	Steam	British	4,326	2,050
† Burriana	,,	,,	,,	1,359	1,200
† Kalomo	,,	,,	,,	5,025	3,000

By The Fairfield Shipbuilding & Engineering Co., Ltd., Glasgow.

Empress of Ireland	Steel	—	Colonial		
t Viper	,,	—	British		
Bosphorus No. 57	,,	—	Foreign	20,043	29,380
Bosphorus No. 58	,,	—	,,		
Volturno	,,		..		

By Ferguson Bros., Port Glasgow.

* Dredger Shieldhill	Steel	Steam	Native	800	1,200
* Dredger No. 3 ..	..	..	,,	200	400
† Dredger No. 9 .	..	..	,,	760	800
† Dredger No. 10 .	.	..	..	760	800
† Dredger Fleetwood	..	..	,,	500	850

By D. Fife & Son, Fairlie.

Sorais and Anitra	Wood	Sail	British	5eaTM	—
Rose	,,	,,	..	80	,, —
m The Ketch ..	,,	—	..	108	,, —
Mirage	..	Sail	Foreign	71	,, -
Eva	,,	,,	British	8	,, —

By Fleming & Ferguson, Ltd., Paisley.

† Hartness	Steel	Steam	British	800	700
† Hopper Steamer .		..	..	830	1,400
† Zmaru	.	..	..	1,300	1,300
† Hopper Steamer	..		..	830	1,400
† Dredger	,		.	1,000	1,000
† Hopper Steamer		.	.	1,400	1,200
† Steamer	.	..	..	600	500
† Dredger	,	..	,,	600	800

* Compound. *t* Turbine. † Triple. *m* Motor.

By J. Fullerton & Co., Paisley.

	Name of Vessel.	Built of	Class.	Owners	G.T. Regis.	I.H.P.
*	Argyll	Steel	Steam	Native	258	443
†	Argus	,,	,,	,,	704	675
*	Oak	,,	,,	,,	340	415
*	Elm	,,	,,	,,	say 340	415
*	Nacunday	,,	,,	Foreign	30	100

By Grangemouth and Greenock Dockyard Co., Greenock.

†	Strathyre	Steel	Steam	British	4,416	2,050
†	Strathspey	,,	,,	,,	4,431	2,050
†	Strathord	,,	,,	,,	4,416	2,050
†	Strathclyde	,,	,,	,,	4,426	2,050
†	Gryfevale	,,	,,	,,	4,423	2,050

(*See also under Forth.*)

By W. Hamilton & Co., Ltd., Port Glasgow.

†	Habana	Steel	Steam	Foreign	1,405	1,200
†	John Hardie	,,	,,	Native	4,372	2,250
†	Banda	,,	,,	Foreign	3,850	2,300
†	Strathfillan	,,	,,	Native	4,353	2,250
†	Luristan	,,	,,	,,	3,280	2,130
†	Muncaster Castle	,,	,,	,,	4,758	2,800
†	Tataristan	,,	,,	,,	3,286	2,130
†	Kentra	,,	,,	,,	4,683	2,800
†	Navarino	,,	,,	,,	5,280	2,800

By David and William Henderson & Co., Ltd., Partick, Glasgow.

Cyclops	Steel	Steam	British	8,008	6,250
Titan	,,	,,	,,	8,054	6,250
Islander	,,	,,	,,	1,105	1,650
Arrina	,,	,,	Colonial	4,484	3,700
Oceana	,,	,,	British	4,846	3,050
Magdala	,,	,,	,,	4,800	3,050

By A. & J. Inglis, Glasgow.

†	Viena	Steel	Steam	Foreign	2,372	2,000
*	Marmion	,,	,,	British	403	1,000

By Lobnitz & Co., Ltd., Renfrew.

†	Beryl		Steam	Foreign	227	550
†	Lord Joicey	—	,,	British	1,204	1,100
*	3 Hopper Barges	,,	,,	Foreign	661ea	690ea
*	Quartus	—	,,	,,	662	690
†	2 Tugs	—	,,	British	142ea	425ea
*	Engines and Boilers	—	,,	Foreign	—	370
	Rockcutter	—	,,	British	105	150
	2 Gold Dredgers	—	,,	Foreign	82ea	100ea
	Machinery (2)	—	,,	,,	-	120ea

By London and Glasgow Engineering and Iron Shipbuilding Co., Ltd., Govan.

†	Rutherglen	Steel	Steam	Native	4,214	2,700
†	Formosa	,,	,,	Foreign	4,469	5,200
†	Pampa	,,	,,	,,	4,471	5,200

By Archd. McMillan & Son, Ltd., Dock Yard, Dumbarton.

Bloemfontein	Steel	Steam	British	4,655	
Elizabeth	,,	,,	Foreign	4,500	
Lord Sefton	,,	,,	British	4,260	
Singapore	,,	,,	,,	4,207	
Visigoth	,,	,,	,,	4,005	
3 Barges for shipment ab'd.	-	-	-	1,490	

By R. McAllister & Son, Dumbarton.

Medora	Wood	Sail	Native	10	—
Pallas	,,	,,	,,	9	—

By P. McGregor, Kirkintilloch.

*	Pioneer and Mars	Steel	Steam	Native	50ea	250ea
*	No. 27	,,	,,	Foreign	85	200
*	No. 21	,,	,,	,,	60	300
†	No. 28	,,	,,	,,	55	200

* Compound. † Triple.

By Mackie & Thomson, Glasgow.

	Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
†	Horatio & Isabel	Steel	Steam	British	174ea	300ea
†	3 Vessels	,,	,,	,,	173ea	300ea
†	Sea Belle	,,	,,	,,	2,132	1,030
†	Junce	,,	,,	Australian	2,252	1,030
†	Macbeth	,,	,,	British	312	650
†	2 Vessels	,,	,,	,,	296ea	550ea
†	J. Baels Mauriex	,,	,,	Belgian	221	400
†	4 Vessels	,,	,,	British	179ea	300ea
†	2 Vessels	,,	,,	,,	185ea	410ea
†	Desdemona	,,	,,	,,	178	300
†	Argyll	,,	,,	,,	280	600

By A. Munro, Ardrishaig.

Ketch Yacht	Wood	Sail	Native	15	

By Murdoch & Murray, Port Glasgow.

Victoria	Steel	Steam	Foreign	355	700
Rio Araguaya	,,	,,	,,	155	300
Virginia	,,	,,	,,	215	300
America	,,	Sail	,,	767	—
Theresa	,,	Steam	,,	202	350
Aymore	,,	,,	,,	433	600
Tupy	,,	,,	,,	432	600

By Napier & Miller, Ltd., Old Kilpatrick.

†	Irish Monarch	—	Steam	British	4,296	2,367
†	Belle of Scotland	,,	,,	,,	5,000	2,500
	Sunlight	,,	,,	,,	1,444	

By John Reid & Co., Ltd., Whiteinch, Glasgow.

Huasco	Steel	Steam	Foreign	3,335	
Aysen	,,	,,	,,	3,356	
Launch	,,	,,	,,	30	
Eun Mara	,,	,,	British	251ym	
2 Lighters	,,	Sail	,,	300	
4 Lighters	,,	,,	Foreign	392	

By Ritchie, Graham & Milne, Whiteinch, Glasgow.

1 Steel Caisson	Steel		Foreign	180	—
2 Stern Wheel Steamers	,,	,,	,,	714	—
2 Paddle Steamers	,,	,,	,,	135	—
15 Barges	,,	,,	,,	2,090	
2 Light Ships	,,	,,	,,	180	
1 Screw Steamer	,,	,,	,,	60	
2 House Boats	,,	-	,,	80	
1 Steel Screw tug	,,	—	,,	50	—

By A. Robertson, Argyllshire.

Launch	Wood	Motor	Foreign	3	—
3 Launches	,,	,,	British	2ea	
Scottie and Baby	,,	Sail	Foreign	6ea	—
Launch	,,	Steam	,,	7	—
Gregellen	,,	Motor	,,	4	

By A. Rodger & Co., Port Glasgow.

Craigisla	—	Steam	British	2,429	1,500
Ardmount	,,	,,	,,	3,509	2,200
Strathnairn	—	,,	,,	4,336	2,600
Crown	—	,,	,,	4,234	2,500
Ellesmere	,,	,,	,,	1,169	1,100
Glenmorag	—	,,	,,	3,535	2,000
Andira and Teffe	—	,,	Brazilian	340ea	550ea

By Russell & Co., Kingston Shipbuilding Yard. Port Glasgow.

Suveric	Steel	Steam	British	6,235	
Kumeric	,,	,,	,,	6,232	
Scottish Monarch	,,	,,	,,	5,042	
Valdivia	,,	,,	,,	4,951	
Eugenia	,,	,,	Foreign	4,903	
Ida	,,	,,	,,	4,782	
Boveric	,,	,,	British	4,445	
Inveran	,,	,,	,,	4,380	
Skerries	,,	,,	,,	4,328	
Drumlanrig	,,	,,	,,	4,284	
King	,,	,,	,,	4,144	
Queen	,,	,,	,,	4,145	
Auchendale	,,	,,	,,	3,951	
Tinhow	,,	,,	,,	1,509	

† Triple.

By Scott & Sons, Glasgow.

	Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P
†	Jacana	Steel	Steam	British	207	500
†	Nankeen	,,	,,	,,	207	500
†	Belmont	,,	,,	,,	209	380
†	Euston	,,	,,	,,	209	380
†	Elswick	,,	,,	,,	215	380
†	Albany	,,	,,	,,	215	380
†	Fritz Busse	,,	,,	Foreign	216	450
†	Alice Busse	,,	,,	,,	218	450
*	White Heather	,,	,,	British	333	500
*	Atlantico	,,	,,	Foreign	157	500
†	King Edward VII.	,,	,,	British	275	430
†	Jon Forseti	,,	,,	,,	250	430
*	No. 185	,,	,,	,,	180	700

By Scotts' Shipbuilding & Engineering Co., Ltd. Greenock.

Dalhanna	Steel	Steam	—	4,661	2,600
Dalblair	,,	,,	—	4,661	2,600
Memnon	,,	,,		4,869	2,500
Astyanax	,,	,,	—	4,871	2,500
Carnarvon	,,	,,	—	514	900
Bardistan	,,	,,	—	3,887	2,200
Cassandra	,,	,,		7,396	5,800
Lurcher & Setter	,,	,,		993ea	2,000ea
Styx & Ackeron	Iron	—	—	165ea	-
H.M.S. Defence (machinery and boilers only)	—	—	-	—	27,000
3 Boilers	—	—			2,000

By J. Shearer & Sons, Ltd., Glasgow.

‡	Argo	Steel	Steam	Native	660	900

By Wm. Simons & Co., Ltd., Renfrew.

Sand Pump Dredger	—	Colonial	1,000	3,875
Pontoon		,,	130	250
Bucket Hopper Dredger		Foreign	1,000	1,620
2 Non-propelling Hopper Barges	—		700ea	—
Tug Steamer		Foreign	120	600
Sand Pump Dredger		Colonial	1,500	4,500
Steam Launch		,,	20	90
Bucket & Pump Hopper Dredger	—	,,	850	2,060
Pontoon		,,	130	—
Bucket Dredger		,,	200	275

By A. Stephen & Sons, Ltd., Glasgow.

Barranca	Steel	Steam	British	4,115	
Victor	,,	,,	,,	175	
Albertville	,,	,,	,,	4,793	
Falaba	,,	,,	,,	4,806	18,700
Crown of Galicia	,,	,,	,,	4,820	
Janeta	,,	,,	,,	4,271	

THE FORTH, &c.

By J. Cran & Co., Leith.

	Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
*	2 Tugs	Steel	Steam	Native	149ea	705ea
†	Yacht, Merel	,,	,,	Foreign	120ym	375
*	Preston, St. Ayles and Violet	Wood	Steam	Native	—	180ea

By Dee Shipbuilding Co., Ltd., Queensferry, Flints.

†	Twin-screw Tug	Steel	Steam	Foreign	40	300
	Tarboat	Wood		British	100	-
*	Motor Barge	Steel	Paraffin	,,	15	30
*	Screw Tug	,,	Steam	Foreign	15	40
*	Screw Launch	,,	,,	,,	12	30
	2 Lighters	,,	—	British	350ea	-
	2 Lighters	,,	—	Foreign	30ea	—
*	Screw Tug	Wood	Steam	,,	18	35
	Motor Launch		Paraffin	British	5	30

‡ Triple. * Compound.

By Grangemouth and Greenock Dockyard Co., Grangemouth.

	Name of Vessel	Built of	Class	Owners	G.T Regis.	I.H.P
†	San Leandro	Steel	Steam	Foreign	1,616	1,250
*	Ap. Peter	,,	Steam	,,	478	750
*	Ap. Paul	,,	,,	,,	480	750
†	Awaji Maru	,,	Steam	,,	1,974	1,480
†	Invergyle	,,	,,	British	1,800	1,200

(See also under Clyde.)

By MacKay Bros., Alloa.

Portia	Steel	S.S.	British	504	—
Klio	,,	,,	German	1,363	-

By J. Miller, Anstruther and St. Monans.

Margorie	Wood	Sail	Native	50	—
Fisherlass	,,	,,	,,	45	—
* St. Ayles and Maggies	,,	Steam	,,	25ea	30ea

By Ramage & Ferguson, Ltd., Leith.

					N.H.P
†	Maund	Steel	Steam	British	903	204
†	Minona	,,	,,	,,	199	47
†	Agawa	,,	,,	Foreign	603	165
†	Melrose	,,	,,	,,	1,653	200
†	O-We-Ra	,,	,,	,,	430	95

By Scott of Kinghorn, Ltd., Kinghorn.

					I.H.P.
†	Santiago De Cuba	Steel	Steam	Foreign	1,493	1,400
*	Devonia	,,	,,	Native	315	500
†	Frousac	,,	,,	Foreign	500	500
	Pontoon	,,	Dredge	British	100	—
	Barge	,,	Towing	Foreign	150	—
	Barge	,,	,,	,,	200	—
	2 Barges	,,	,,	British	50ea	—
*	Rose	,,	Steam	,,	60	200

By Hawthorns & Co., Ltd., Leith.

	Lightship	Steel		British	175	—
†	Roslin Castle	,,	Steam	,,	391	1600
	2 Gas Boats	,,		,,	25ea	-
*	Caroline	,,	,,	French	200	250
*	Scout & Ranger	,,	,,	British	80ea	150ea
†	Adele	,,	,,	,,	350	400

By J. Weatherhead, Eyemouth.

Margaret Dawson	Wood	Sail	—	38	—
Violet	,,	,,		35	—
St. Ebba	,,	,,	—	30	—
* Faithful	,,	Steam	—	76	—

THE TAY, &c.

By Gourlay Bros. & Co. (Dundee), Ltd., Dundee.

Londres	Steel	Steam	Foreign	2,670	4,100
Woodcock	,,	,,	British	1,673	3,250
Registan	,,	,,	,,	2,847	2,350
Phrygie	,,	,,	Foreign	3,800	3,200
Princess Ena	,,	,,	British	1,202	2,200
Emanuel M. Underdown	,,	,,	Foreign	447	700

By The Caledon Shipbuilding & Engineering Co., Ltd., Dundee.

†	Aranmore	Steel	Steam	British	1,134	1,560
	2 Barges	,,	-	,,	80	—
a	Duke of Montrose	,,	,,	,,	1,390	3,800
†	Perak	,,	,,	Foreign	1,188	1,520
†	Lanfranc	,,	,,	British	6,500	4,500
†	Dundee	,,	,,	Colonial	2,278	1,200

† Triple. * Compound. *a* Quadruple.

By Dundee Shipbuilders' Co., Ltd., Dundee.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P
† Adventure ..	Steel	Steam	British	1,761	2,000
††Kinfauns Castle.	,,	,,	,,	183	320
† Mary	,,	,,	,,	256	420
† Uhden	,,	,,	,,	191	380
† Teesmouth ..	,,	,,	,,	191	380
† Guaza	,,	,,	Foreign	300	
3 Barges for shipment	,,	—	,,	900ea	—

By The Montrose Shipbuilding Co., Montrose.

* E. L. Lawson ..	Steel	Steam	Native	204	
* Fortuna	,,	,,	,,	214	—
† Ban Hong Liong	,,	,,	Foreign	1,127	—
† Capella	,,	,,	,,	300	—
* Montrose	,,	,,	Native	204	-

THE DEE

By Hall, Russell & Co., Ltd., Aberdeen.

3 Trawlers ..	—	Steam	British	195ea	400ea
Pointer	—	,,	,,	198	400
Adventure ..	—	,,	,,	184	400
W. Wetherly	—	,,	,,	234	450
Swallow	—	,,	,,	204	
Rambow	—	,,	,,	170	380
North King and North Queen	—	,,	,,	195ea	440ea
6 Trawlers ..	—	,,	,,	202ea	440ea
3 Trawlers ..		,,	,,	172ea	400ea
Briton	—		,,	170	400
Kei Nevel ..		,,	Foreign	182	450
Balmoche ..			British	204	420
Ethel Hutten ..		,,	,,	170	400
Rosskeen		,,	,,	202	420

By Alexander Hall & Co., Ltd., Aberdeen.

Albatross ..	-	-	British	220	38
Hope				191	180
Loch Earn				202	350
Fort Albert ..				193	350
Olive	—			85	180
Ebenezer				84	180
Princess Royal .				284	480
Princess Maud..				278	400
No. 427				202	350

LIST OF VESSELS ENGINED IN 1906.

By J. Abernethy & Co., Aberdeen.

Name of Vessel	Builders	I.H.P	Press. lbs.
† Venus	John Duthie Torry Shipbuilding Co	540	—
* Star of Liberty	,, ,,	470	-
† Loch Torridon.	,, ,,	500	
† Bunte Kuh ..	,, ,,	540	
* Mary Stephen	,, ,,	240	
* Sparkling Star	,, ,,	170	
* Guiding Star and Queen	,, ,,	220ea	—
* Olive and Trustful	Carnegie & Matthew, Peterhead	170ea	
	Total	..	3,240

By Aitchison, Blair & Co., Clydebank.

‡ Kinfauns Castle ..	Dundee Shipbuilders Co. Ltd.	320	145
ƒ One Vessel ..	Foreign	240	140
† Fritz Busse ..	Scott & Sons, Bowling ..	450	180
† Alice Busse ..	,, ,, ..	450	180
ƒ One Vessel ..	Foreign	110	160
ƒ ,, ...	,, ...	160	125
	Total	.. ..	1,730

† Triple. †† Twin Compound. * Compound.
‡ High Pressure. ƒ Compound Non-Condensing.

By Allan Anderson & Co., Pollokshaws, Glasgow.

Name of Vessel.	Builders.	I.H.P	Press lbs
† May Island ..	Messrs. Mackie and Thomson	410	170
† Inchkeith ..	,, ,, ...	410	170
† Resolute ..	Ardrossan Shipbuilding Co. Ltd.	410	180
† Neyland ..	,, ,, ..	420	180
	Total	1,650	

By Campbell & Calderwood, Paisley.

‡‡— ..	Foreign	25	—
2 Sets	Ritchie, Graham, and Milne	700	—
		200ea	—
	,, ,, ...	140	—
‡‡		80	
‡‡	Foreign	50	—
‡‡		100	
3 Sets	,, ...	60ea	—
2 ,, ...		35ea	—
	Alley & McLellan Ltd...	700	—
		50	—
2 Sets	Ritchie, Graham, and Milne	300ea	
		30	—
‡‡	Ritchie, Graham, and Milne	60	
‡‡	,, ,, ..	160	
‡‡	Foreign	100	—
,,	,, ...	30	—
,,	,, ...	50	—
‡‡	.. ..	650	
†	.. ..	650	
‡‡	,, ...	300	
27 Sets	Total	3,895	

By Clyne, Mitchell & Co., Aberdeen.

† Ben Cruachan	John Duthie Torry Shipbuilding Co...	420	180
† Concord, Mistletoe, Guiding Star, and Boy George.. ..	W. R. McIntosh ..	200ea	180ea
* Industry .	W. Geddes .. .	144	130
* Thistle	Alex. Slater	120	150
† Daisy, Gowan, Economy, and Hero . ..	W. Geddes	200ea	180ea
† Ben Alligin and Ben Roy	John Duthie Torry Shipbuilding Co...	400ea	180ea
	Total ..	3,084	

By Colin, Houston & Co., Ltd., Kinning Park, Glasgow.

‡‡ Ailsa ..	Ailsa Shipbuilding Co. Ltd. Troon	150	130
‡‡(Old Vessel) ..	— ,, ..	150	100
‡‡No. 21	P. McGregor & Sons, Kirkintilloch	275	130
‡‡(For Shipment)	— ,, ..	150	100
	Total . ..	725	

By Cooper & Greig, Dundee.

† 1 Set	1,000	
† 1 ,, ...	800	
Total ..	..	1,800

† Triple. ‡‡ Twin Compound. c Single Cylinder.
* Compound.

By Denny & Co., Engine Works, Dumbarton.

Name of Vessel.	Description of Machinery.	Trade.
Colaba	Triple Single Screw	Eastern
Rewa	Turbine	Eastern
Asuncion	Triple Paddle	River
Orari	Triple Twin Screw	Colonial
Corumba	Triple Paddle	River
Duchess of Argyll	Turbine	River
Kingfisher	Turbine	River
Ava	Triple Single Screw	Eastern
Opawa	Triple Twin Screw	Colonial

Also machinery for various Paddle Steamers built abroad.

Total Indicated Horse Power 44,200

By Dunsmuir & Jackson, Ltd., Govan.

Name of Vessel	Builders.	I.H.P.	Press. lbs.
* Kilkerran	Chas. Connell & Co. Ltd.	1,950	
† Visigoth	Arch. McMillan & Son Ltd.	1,800	—
* Huasco Aysen	John Reid & Co. Ltd	4,100ea	
† Candidate and Commodore	Chas. Connell & Co., Ltd.	2, ea	-
* Inverclyde	,, ,,	2,250	
* Elizabeth	Arch. McMillan & Son, Ltd.	2,500	
* King and Queen	Russell & Co.	2,5 ea	—
* Crown	A. Rodger & Co.	2,5	
* Bloemfontein	Arch. McMillan & Son, Ltd	2,5	-
† Valbanera	Chas. Connell & Co., Ltd.	2,775	—
* Awaji Maru	Grangemouth & Greenock Dockyard Co.	1,5	—
† Belle of Scotland	Napier & Miller, Ltd.	2,250	
† Frankdale	Chas. Connell & Co., Ltd	2,25	
Satrunji	(Two boilers		—
	Total	41,325	

By Fisher & Co., Ltd., Paisley.

‡‡Faithful	Larne Shipbuilding Co., Ltd.	1	100
‡Pioneer and Mars	P. McGregor & Sons	225ea	130ea
‡‡Lady Elsie	G. Brown & Co.	225	130
‡Elm	J. Fullerton & Co.	100	130
	Total	1,205	

By Gauldie & Gillespie & Co., Glasgow.

* Belmont Euston, Elswick, and Albany	Scott & Sons	1	180ea
* Gem, Vallar Crown, Excel, and Morning Star	Shipped		130ea

By Hutson & Sons, Ltd., Kelvinhaugh Engine Works, Glasgow.

Arethusa	Ailsa Shipbuilding Co., Ld.		
* Mercury	,, ,,	750	—
* Argo	J. Shearer & Sons, Ltd.		
Ap. Peter	Grangemouth & Greenock Dockyard Co.		
Ap. Paul			
	Total	4,300	

By John G. Kincaid & Co., Ltd., Greenock.

Strathtay, Strathyre, Strathspey, Strathord, Strathclyde, and Gryfevale	Grangemouth & Greenock Dockyard Co., Greenock	2, ea	180ea
Auchendale	Russell & Co., Port Glasgow	2,5	180
John Hardie	Wm. Hamilton & Co., Ltd	2,5	180
	Total	18,000	

* Compound. * Triple. ‡‡ Compound Surface Condensing Compound Diagonal

By W. V. V. Lidgerwood, Coatbridge.

Name of Vessel	Builders.	I.H.P.	Press. lbs.
† Macbeth	Mackie & Thomson, Govan	650	185
* 10 Vessels	,, ,,	300ea	200ea
† 4 Vessels	Smith's Dock Co., Ltd., North Shields	400ea	180ea
* Diligence	J. Duthie, Sons & Co., Aberdeen	250	125
† 3 Barks Mauriex	Mackie & Thomson, Govan	400	180
† 7 Vessels	J. Duthie, Sons & Co., Aberdeen	420ea	180
† Capella	Montrose Shipbuilding Co. Montrose	550	180
† Socrates	Mackie & Thomson, Govan	550	200
† Greta	John Duthie, Torry	450	180
† Loch Avon	J. Duthie, Sons & Co., Aberdeen	400	180
† Argyll	Mackie & Thomson, Govan	600	200
† King Edward VII.	Scott & Sons, Bowling	460	180
† Uhdea and Teesmouth	Dundee Shipbuilding Co., Dundee	400ea	180ea
† Ocean	J. Duthie, Sons & Co., Aberdeen	450	180
† Siluria	Goole Shipbuilding Co., Goole	420	180
† Jon Forsetti	Scott & Sons, Bowling	425	180
* Cameo	Smith's Dock Co., North Shields	420	180
	36 Sets Total I.H.P.	14,365	

By McKie & Baxter, Copland Works, Govan, Glasgow, have constructed 45 sets of Marine Engines aggregating 7,005 I.H.P. 20 sets were fitted on board vessels built by John Fullerton & Co., John Reid & Co., Ltd., The Ailsa Shipbuilding Co., Ltd., George Brown & Co., and various builders of Fishing Vessels on the North-East of Scotland; the remainder being sent abroad. The types constructed were Triple Expansion, Compound Surface Condensing, Compound Non-Condensing, High Pressure, and Diagonal Compound Surface Condensing Paddle Engines.

By Menzies & Co., Ltd., Leith.

* White Heather	Scott & Sons, Bowling	550	130

By Muir & Houston, Ltd., Kinning Park, Glasgow.

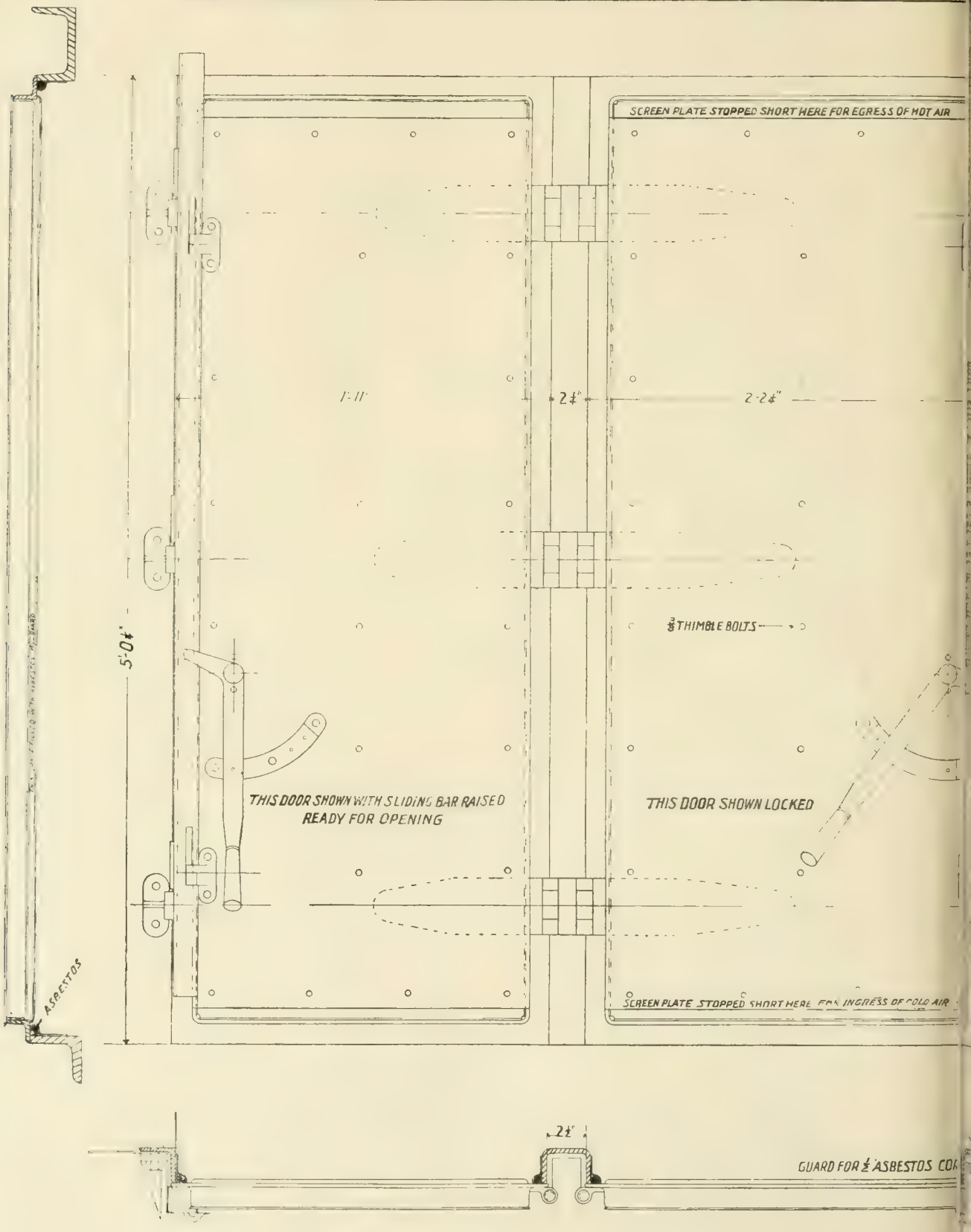
† Habana	Wm. Hamilton & Co., Port Glasgow	1,200	-
* Wheatear	Ailsa Shipbuilding Co., Troon	550	—
* Wheatsheaf	,, ,,	650	
† Eun Mara (S.Y.)	John Reid & Co., Whitemich	500	
† Cambro	Campbeltown Shipbuilding Co.	1,300	—
† Jequintinhonha, Marahu, and Commandatuba	Ailsa Co.	1,200ea	
* Ailsa Craig	,,	750	-
† Burmana	Robert Duncan & Co., Port Glasgow	1,300	
* Tug	Scott & Sons, Bowling	750	-
* Veledho	G. Brown & Co., Greenock	600	
	Total	11,200	

By Rankin & Blackmore, Greenock.

† Boveric, Ida, Skerries, and Inveran	Russell & Co.	2,500ea	180ea
* Valdivia	,,	2,500	180
† Kumeric	,,	3,500	180
† Tinhow	,,	1,500	180
† Kaffir	Robert Duncan & Co., Ltd.	3,000	180
* No. 400	A. McMillan & Son Ltd.	2500	
	Total	23,200	

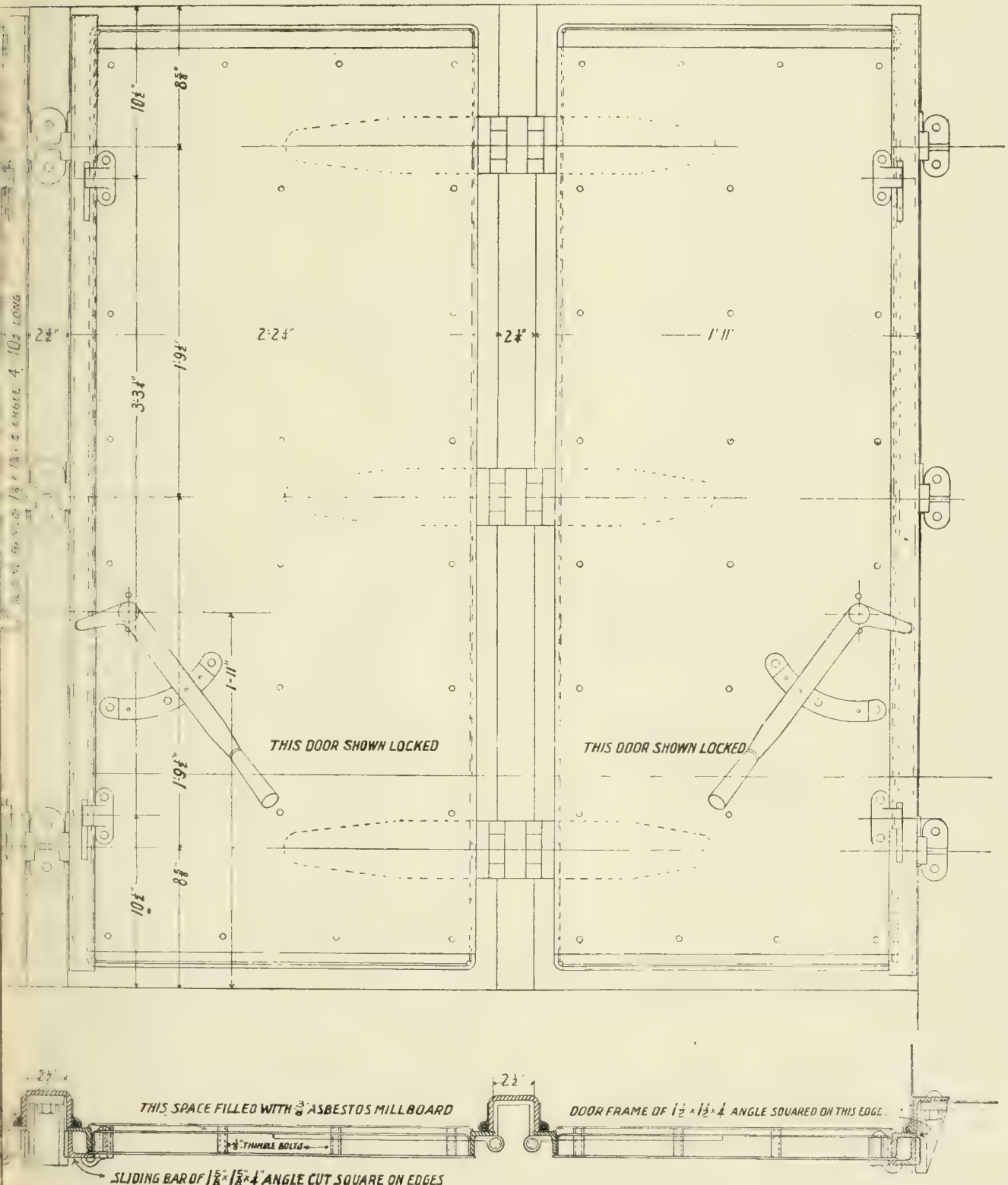
* Compound. † Triple.

ARRANGEMENT OF SILLEY'S PATENT AIR TIGHT SMOKE B


SCREEN PLATE STOPPED SHORT HERE FOR EGRESS OF HOT AIR
1'-11"
2½"
2'-2½"
⅜ THIMBLE BOLTS
5'-0"
THIS DOOR SHOWN WITH SLIDING BAR RAISED READY FOR OPENING
THIS DOOR SHOWN LOCKED
ASBESTOS
SCREEN PLATE STOPPED SHORT HERE FOR INGRESS OF COLD AIR
2½"
GUARD FOR ½ ASBESTOS COA

...x DOORS FOR BOILERS OF ADMIRALTY TYPE

— SCALE 3" = 1 FOOT —



By Renfrew Bros. & Co., Irvine.

Name of Vessel	Builders	I H P	Press lbs
* Argyle & Oak	John Fullerton & Co., Paisley	1500a	2[illegible]a
* Retriever	Ailsa Shipbuilding Co., Troon	[illegible]	130
* Brookfield	Ardrossan Shipbuilding Co	[illegible]	1[illegible]
* Sheila	Ailsa Shipbuilding Co Ayr	550	130
Total ..		[illegible]	

By A. Rodger & Co., Govan.

* Creeksla ..	A. Rodger & Co., Port Glasgow	1,[illegible]	
* Ardmount	,,	2,200	
* Strathnairn	,,	2,600	
* Glenmorag	,,	2,000	
3 Gas Engines		420	
1 Gas Engine ..		400	
Total ..		[illegible]	

By Ross & Duncan, Whitefield Works, Govan.

* Set	For S.S. Sanidad ..	[illegible]	
* 1 ,,	,, S.S. Virginia ..	[illegible]	
* 1 ,,	,, S.S. Voreda	650	
* 1 ,,	,, S.S. Colwith Force ..	[illegible]	
* 1 ,,	,, S.S. Argus	750	
* 1 ,,	,, S.S. Theresa	[illegible]	
* 1 ,,	,, S.S. Berne	[illegible]	
* 1 ,,	,, S.S. Galava	[illegible]	
* 1 ,,	,, S.S. Atlantico ..	[illegible]	
†	,, S.S.'s Avance & Tujo	[illegible]	
* 1 ,,	,, S.S. Ellesmere	1,[illegible]	
* 1 ,,	,, S.S. Andira & Teffe ..	[illegible]	
Also 17 sets of Marine Engines shipped abroad ..		[illegible]	
33 sets of Engines	Total ..	[illegible]	

By David Rowan & Co., Glasgow.

† Mistor ..	Campbeltown Shipbuilding Co. ..	1,[illegible]	[illegible]
† English Monarch	Napier & Miller, Ltd. ..	2,[illegible]	1[illegible]
* Victoria ..	Murdoch & Murray	[illegible]	120
* Winga ..	Wm. Hamilton & Co., Ltd. ..	2[illegible]	180
* Drumcairne ..	Russell & Co. ..	[illegible]	[illegible]
* Strathairly ..	R. Duncan & Co. ..	2,[illegible]	180
* Ganges ..	C. Connell & Co., Ltd. ..	2,500	2[illegible]
* Drumlanrig	Russell & Co. ..	[illegible]	180
* Sea Belle	Mackie & Thomson	1,[illegible]	[illegible]
* Strathfillan	Wm. Hamilton & Co., Ltd	[illegible]	180
* Banda ..	..	[illegible]	[illegible]
* Luristan ..	..	2,150	[illegible]
* Suveric ..	Russell & Co. ..	3,500	[illegible]
* Irish Monarch	Napier & Miller, Ltd.	2,[illegible]	1[illegible]
* Muncaster Castle ..	Wm. Hamilton & Co., Ltd.	2,[illegible]	[illegible]
* Tabaristan	..	2,[illegible]	[illegible]
* Eugenia ..	Russell & Co. ..	[illegible]	1[illegible]
* Apollo ..	Campbeltown Shipbuilding Co. ..	[illegible]	180
* Scottish Monarch ..	Russell & Co. ..	[illegible]	1[illegible]
* Kentra ..	Wm. Hamilton & Co., Ltd.	[illegible]	[illegible]
Total..		[illegible]	

By Gourlay Bros. & Co. (Dundee), Ltd., Dundee.

[illegible]	3 sets	[illegible]	
[illegible]	1 ,,	[illegible]	
* [illegible]	1 ,,	[illegible]	
* [illegible]	1 ,,	2,350	—
* [illegible]	[illegible]	[illegible]	
* [illegible]	[illegible]	[illegible]	
* 4[illegible]	1	[illegible]	
* 4[illegible]	[illegible]	[illegible]	
Total.		[illegible]	

*Compound. †Triple. ‡‡Twin Compound.

By Alex. Shanks & Son, Ltd., Arbroath.

Name of Vessel.	Builders	I H P	Press lbs.
1 Set ..		[illegible]	—
[illegible]	For Malta ..	240	—
1 ,, ..	Clyde Builders ..	[illegible]	—
1 ,, ..	,, ..	80	—
1 ,, ..	For Santander	80	—
1 ,, ..	,, Spain ..	100	—
1 ,, ..	Edwards & Co ..	112	
1 ,, ..	Montrose Shipbuilding Co.	[illegible]	
Vertical Engines	Monte Video ..		
2 Horizontal Engines	Clyde Builders ..	600	—
Total ..		1,702	

By White & Hemphill, Ltd., Roxburgh Engine Works, Greenock.

* Bull ..	Geo. Brown & Co...	[illegible]	—
Rio Araguaya .	Murdoch & Murray	[illegible]	—
Steel Tug ..	P. McGregor & Sons	[illegible]	—
2 Sets Marine Engines ..	Foreign	[illegible]	—
Various High Speed Engines and Centrifugal Pumping Engines, &c. ..		120	—
Total		1,380	

IRISH.

By Harland & Wolff, Ltd., Belfast.

a Heroic ..	Steel	Steam	[illegible]	6,300
a Amazon ..			[illegible]	[illegible]
a Graphic ..			[illegible]	6,300
a Ortega ..			[illegible]	6,600
a Matheran ..			[illegible]	[illegible]
a Oronsa ..			[illegible]	6,600
a Adriatic ..			25,000ab	16,100
† Salamanca ..			[illegible]	[illegible]
a Rohilla ..			[illegible]	[illegible]
† Aburi ..			[illegible]	[illegible]
† Sierra Leone ..			[illegible]	[illegible]
a Minotaur ..				27[illegible]
H.M. 1st Cl. Cruiser (building)				

By Workman, Clark & Co., Ltd., Belfast.

City of Glasgow	Steel	Steam	[illegible]	4,500
Argentaya ..			10,[illegible]	8,500
Belgravia ..			[illegible]	[illegible]
Chirripo ..			[illegible]	[illegible]
Revontazon ..			[illegible]	3,550
Japan			[illegible]	5,500
Star of Japan ..			[illegible]	[illegible]
City of London			[illegible]	[illegible]
Howth Head ..			4,440	[illegible]
Salaga ..			[illegible]	3,750
Gando ..			[illegible]	3,750
Lethe (Barge)	Iron			
Avernus (Barge)				

By The Dublin Dock Yard Co., Dublin.

* Berne ..	Steel	Steam	[illegible]	[illegible]
Motor Launch	Wood	Oil	[illegible]	30
Auxiliary Yacht	,,	Auxil.	7	0

By The Larne Shipbuilding Co., Larne.

* Faithful ..	Steel	Steam	[illegible]	[illegible]

LIST OF VESSELS ENGINED IN 1906.

IRISH.

By MacColl & Co., Ltd., Abercorn Basin, Belfast.

* Glenravel ..	Steel	Steam	[illegible]	[illegible]
Ltd., Troon ..			[illegible]	[illegible]

*Compound † Triple. ‡‡Twin Compound. a Quadruple.

FRENCH.

By Baheaux Brothers, Boulogne-sur-Mer.

	Name of Vessel	Built of	Class	Owners	G T Regis	I H P.
*	L'Aigle	Wood	Steam	Boulogne	50	130
	Notre Dame des Victoires		Sail		163	—
	Sacré Cœur de Jésus				82	—
*	Frédéric Sauvage		Steam and Sail		105	135

By The French Engineering & Shipbuilding Co., Dunkirk.

†	Li Ta	Steel	Steam	French	3,114	1,700
†	St. Pierre Miquelon				845	750
	4 Lighters					
†	Mouette and St. Pierre				303 ea.	520 ea
†	La Rochelle				850	650
*	Emma				150	150
†	S. Jean & Liberté				303 ea.	520 ea.
†	Savoie				384	650

By Augustin Normand & Co., Havre.

†	Nos. 295, 299, 318, 319, 320 and 321	Steel	Steam	French	Gt. 100 ea.	2,000 ea.
‡	Destroyer "Claymore"				350	7,000

By Societe Anonyme des Chantiers et Ateliers de St. Nazaire, Penhoet.

†	Ernest Renan	Steel	Steam	Marine militaire	10,000	30,000
†	Guadeloupe and Perou			C G. T.	ea. 6,800	ea. 6,200
†	Chicago				10,400	9,000
†	Paquebot K.				4,100	10,000

By The Mediterranean Shipbuilding Works, La Seyne.

*	Admiral Makaroff	Steel	Armour'd Cruiser	Russian Govt.	5,745	10,500
	4 Coal Barges	—	—	French Govt.	110 ea	
	4 Rubbish Barges	—	—	—	11	
	2 Tank Barges			Messageries Maritimes	31 ea	—

By The Provence S. & Engineering Co., Ltd., Port de Bouc.

†	Saint Malo	Steel	Steam	French	1,100	850
†	Saint Servan				1,100	850
†	l'Herault				2,600	1,400
	Lightship	Iron	Station'y	Foreign		

By Schneider & Co., Le Creusot.

†	Torpedo boats, Nos. 353 & 358	Steel	Steam	French Govt.	99	2,000
†	Nos. 325 & 331				99	
†	Nos. 359 & 305				99	
†	Destroyer, Yar Hissar			Foreign	305	6,300

BELGIAN.

By Chantiers Navals Anversois, Antwerp.

	Name of Vessel	Built of	Class.	Owners	G T Regis.	I H P
†	Mostar and Henri Gerlinger	Steel	Steam	Foreign	1,218 ea	790 ea
‡	Djero				1,510	900

By Chs. Deloaux. Boom.

p	"Albert II."	Steel	—	Native	50	35
p	"Risico"				150	30
p	"Embleve"				150	35
p	Motor Launch				—	8
p	"Vitesse"		—		50	20
	"Liberté"		Sail		1,050	—
	"Julie"				650	
	"Adolphine" and "Bertha"				350 ea.	-

* Compound. † Triple. *p* Petrol.

By Aug. Hamman, Ostend.

Name of Vessel	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
"Princesse Charlotte," "Anna" "de Tonge Hendrik," and "Elvize-Marie"	Wood	Sail	Ostend	46 ea.	—

By Societe Anonyme John Cockerill, Hoboken.

†	Vitiaz	Steel	Steam	Foreign	1,019	1,500
‡	Stern Wheel				103	150
‡	Stern Wheel				40	150
*	Emile				19	30
p	Olnna		Oil essence		6	30
p	L'Etincelle			Belgian	3	24
	2 Barges		—	Foreign	124	—
	2 "		—		120	
	1 "				50	—
	1 "		—		88	—
	2 Caissons Pontoons				375	—
	2 Floating Stages				132	

DUTCH.

By Wed. C. Boele & Son, Stikkerveer.

	Name of Vessel	Built of	Class	Owners	G T. Regis	I H P
	No. 25	Steel	Sail	Germany	1,523	-
†	Constantina		Steam	Dordrecht	150	350
†	President van Strydonch			Belgium	80	175
†	Directem Letred				80	175
†	Elise				100	175
	No. 21		Sail	Germany	600	
	Morgenster V.			Belgium	1,085	
	Morgenster VI.				1,100	—
	Jubenne			Rotterdam	1,647	—

By Gebr G. & H. Bodewes, Martinshoek.

"Bertha," "Catharina," and "Margaretha"	Steel	Sail	German	100 ea.	—
Neezartie			Dutch	200	
5 vessels			German	85 ea.	
"Detijd zal't leeren H."		Steam	Dutch	95	20
"Dana Anna"				925	—
"Adele"		Sail	German	185	
"Kathe Luise"				100	-
"Greta No. 7" and "Hilda No. 8"				200 ea.	

By H. H. Bodewes, Millingen.

	Bertha Maria	Steel		Germany	1,400	—
	Klara		—		1,500	-
	Anna Amalia				800	-
	Eben Ezer II.			Belgium	1,700	—
	Die Liebe Gottes			Germany	700	
m	Vriendschap		—	Dutch		12

By Bonn & Mees, Rotterdam.

†	Jean Doré and Lillois	Steel	Steam	France	200 ea.	430 ea.
	Pontoon		—	Germany	800	—
†	Phecda			Dutch	3,000	1,300
†	Dredger			Germany	250	250
†	Surmulet and Friedland			France	260 ea.	430 ea.
†	Freia			Dutch	265	375
†	Goeland and Fleuriette			France	265 ea.	470 ea.

* Compound. † Triple. *m* Motor.

By Jonker Gebr Scheeps Baumeisters, Kinderdijk.

Name of Vessel	Built of	Class	Owners	G T Regis D.W.	I H P.
Pauline	Steel	–	Dutch	700	
Anna			,,	500	–
* Ons Vorlangers			,,		75
† Adige			Foreign		120
* Titans			Dutch	-	250
* Cjeedermalsers			,,	150	100
m No. 305			Foreign	50	20
André			Dutch	1,500	-
No. 300			Foreign	1,500	
Jaioba			Dutch	400	
No. 1088					20
Noord			,,	900	
No. 304			,,	50	

By Koninklijke Nederlandsche Grofsmiderij, Leiden.

* 1 Bucketdredger	Steel	Towed German		330	275

By Maatschappij voor Scheeps-en Werktuigbouw, "Fijenoord," Rotterdam.

† Zeemeeuw (pilot)	Steel	Steam	Dutch	220*d*	350
† 4 Torpedo boats	,,	,,	,,	160*d* ea.	2100ea
† Tjibodas			,,	4,028*d* g.	2,000

By Jan F. Meursing, Amsterdam.

††Havenpolitie	Steel	Steam	Dutch		75

By The Nederlands Shipbuilding Co., Amsterdam.

† Pahud	Steel	Steam	Dutch	1,805	1,000
a Rembrandt				5,860	4,000
† Koningin Wilhelmina				181	250
† Achilles				2,161	1,000
† Atlas				1,818	1,000

By J. J. Pattje & Son, Waterhuizen.

Ebenhaezer	Steel	Sail	Native (Dutch)	250*d*	
Nieuwe Zorg	,,			120	
Friedrich	,,	,,	German	65	,,
Hermine	,,	,,	,,	120	,,
---			Native	120	
				25	
Heinrich Linnemann			German	230	,,

By Rotterdamsche Droogdok Maatschappij, Rotterdam.

† Alwina	Steel	Steam	Dutch	1,150	750
Zeelandia	,,	Sail	,,	590	
† Constance Catherina	,,	Steam	,,	1,200	1,000
† Suez	,,	,,	,,	250	450

By The Royal Shipbuilding & Engineering Co., De Schelde, Flushing.

† Rindjani	Steel	Steam	Native	4,931	3,650
† Draak and Krokodil	,,	,,	,,	83d, ea.	1,300ea.
† Jikini	,,	,,	,,	4,630	1,700
† Termini	Engines only		Foreign	—	1,000
† Ellewotsdijtz			Native	-	1,100
† Pheeda Maashaven			,,	—	1,300ea.
† Haakon VII.			Foreign	—	1,100

By J. Smit & Cz., Alblasserdam.

† Termuni	Steel	Steam	German	1,558	1,000
† Ellenvoutsdyk	,,	,,	Dutch	2,229	1,100

By J. Van Aller, Hasselt.

No. 57	Steel	Sail	—	140	
No. 61	,,	,,	—	155	
No. 60	,,	,,		143	—

* Compound. † Triple. †† Twin Compound.
a Quadruple. *m* Motor.

By M. Van Der Kuyl, Slikkerveer.

Name of Vessel.	Built of	Class	Owners	G T Regis	I H P
Achilles, Magda and Leni	Steel	Sail	Germany	100 ea.	
2 Lighters	,,	—	,,	1,050 ea.	—
1 Lighter	,,		Dutch	1,350	

By Van Vliet & Co., Hardinxveld.

Albertha and Dorethea	Steel	—	Antwerp	1,060 ea.	—
† Borea and Nicolas	,,	Steam	Foreign	600 ea.	375 ea
Valerie II.	,,	—	Antwerp	2,025	—
3 barges			Foreign	100	
Rhein. Schiffahrts Ges. 6	,,	riv. lighter	,,	1,810	–

By Werf Conrad, Ltd., Haarlem.

* No. 344 golddredger	Steel	–			70
No. 345	,,			—	
**Düsseldorf	,,		Dutch	—	900
No. 348	,,	—			—
* No. 349 352 golddredgers	,,	—	Foreign		90
* No. 353 tugboat	,,		,,	–	75
* No. 355 bucket dredger	,,	–	,,		25
* No. 350 golddredger	,,		,,		90

By N. V. Werf, v/h Rijkee & Co., Rotterdam.

† Neptunus and Uranus	Steel	Steam	Dutch	1,580 ea.	900 ea.
† Westland	,,	,,	,,	1,280	,,

By Wilton Slipway & Engineering Co., Rotterdam.

† Schelde	Steel	Steam	Dutch	350	1,000
† Balder	,,	,,	,,	250	400
m Sigrid and Jung Deutschland	,,	Petrol	German	6 ea.	20 ea.
† Adige		Steam	Italy	50	150
* Furness I.	,,	,,	Dutch	75	250

By A. J. Otto & Sons, Krimpen a.d. Ysel.

4 River Lighters for Bangkok. 5 Sea-going Lighters for Bangkok. 1 Steam Launch for Bangkok. 3 Tugs for the Netherlands. 4 Lighters for Germany. 1 Cargo Boat for Belgium.

By P. & A. Ruztenberg, Waspik.

Joseph	Tug	—	360	
Jakoba Maria	Sail	—	165	—
Gerard Antoine	Tug		1,000	—
Adriana Maria	,,	—	545	
Joseph Marie	,,	—	670	—
Geertriuda	,,		385	—

By E. J. Smit & Zoon, Hoogezand.

m De lijd zal lleeren	Steel	—	—	25	8
Oldebert	—	—	—	40	16
2 Vessels		—	Dutch	100ea	30ea
Emden	—	—	—	45	10
Marienfels II.	—	Tug		1,500	
Vitesse	Steel	Motor		20	4
Risico		Sail	—	209	—
Nijverherd	—	,,	—	145	—
m De Lijd	—			170	30
4 Tugs	Steel	—	—	420ea	—
Georg		Steam	—	40	100
2 Lighters	—	—	—	300ea	—

Firma A. F Smulders, Schiedam, Rotterdam.

Suction Dredger			Foreign	500	186
4 Steam Hoppers	—		,,	700ea	750ea
Suction Dredger	–		,,	470	220
Bucket Dredger	–	-	,,	350	250
Coaling Vessel	—	—	Dutch	200	550
Steam Yacht	—	—	Foreign	70	35
Bucket Dredger			,,	250	160
Tug Boats		-	,,	250ea	75ea
Suction Dredger	—	—	,,	350	235

* Compound. ** Triple Compound. † Triple. *m* Motor.

By K. & J. Koopman, Dordrecht.

	Name of Vessel	Built of	Class	Owners	G.T Regis.	I H.P
‡‡	Neiltje	Steel	Steam	Dutch	—	85
†	s. Hestogentosch 2	,,	,,	,,	—	250
†	Avon	,,	,,	,,	—	250
‡‡	Ooster Schelde	,,	,,	,,	—	90
‡‡	Johan Gerardus	,,	,,	,,	—	160

By J. & K. Smit, Kinderdijk a Krimpen, a/d Lek, Holland.

†	Rozenburg	Steel	Steam	Dutch	—	350
*	Kijkduin	,,	,,	,,	—	150
†	Zwarte Zee	,,	,,	,,	—	1,500
*	M.O.P. 18 C	,,	,,	Foreign	—	200
	No. 592 (Pontoon)	,,	—	Dutch		
†	Beverwijk IV.	,,	Steam	,,	—	550
*	Stad Amsterdam III.	,,	,,	Foreign	—	100
*	Louisa	,,	,,	Dutch	—	80
†	Noord-Holland	Iron and Steel	,,	,,	—	180
	Nos. 580, 581, 582, 583	Steel	—	Foreign	—	—

By W. F. Stoel & Zoon, Alkmaar.

m	8 Vessels	Steel	—	-	-
	3 Vessels	,,	Sail	—	-
	De Gunot	,,	Steam	-	-

By J. Meyers Shipbuilding Co., Zalt. Bommel.

	Pontoon	Steel	—	Dutch Govt.	420	—
	Motor Barge	,,	—	Dutch	110	55
*	Bucket Dredger	,,	—	,,	288	140
*	Almirante Gravina	,,	Auxil. Schooner	Foreign	600	195
	6 Barges	,,	Towing	,,	1,800	—
	Sea Lighter	,,	,,	,,	600	—
	Flying Bridge	,,	—	Dutch	40	—
	7 Barges	,,	,,	Foreign	4,200	—

LIST OF VESSELS ENGINED IN 1906.

By Stork Bros. & Co., Huegelo.

	Name of Vessel.	Builders	I H P	Press lbs.
†	Goedhardt	Werf-Conrad, Haarlem	750	160
*	Zutfen I., Minkisso, Zutfen II., Zutfen III., and Zutfen IV.		200 ea.	90 ea.
†	Almeria		600	160
†	Cadix		250	160
*	No. 355		150	90
*	Siam		75	90

By The Alblasserdamsche Engineering Works, Alblasserdam.

†	Combinatic VII.	Old vessel	620	195
c	———		20	
†	Beverwyk IV.	Y. & R. Smit (dredger)	400	180
‡	———		150	
†	Greta (tug)	A. Z. Otto en Zoon	220	180
†	Kvimulet (trawler)	Bonn en Mees	440	180
†	Goeland	,,	485	180
	———		400	
†	Dredger	L. Smit en Zoon	150	180
**	2 Tugs	Wed. C. Boele en Zoon	225ea	135ea
†	Norway	Old Tug	385	180
c	August	,,	30	180
†	2 Tugs	Zonker en Stans	140ea	180ea
†	2 Trawlers	Bonn en Mees	440ea	180ea
†	———		180	180
c	Dredger	Yen K. Smit	20	180
*	Titan (tug)	Gebr, Zonker	280	150
†	Elise(tug)	Wed. C. Boele en Zoon	220	180

* Compound. ** Triple Compound. † Triple.
†† Twin Compound. *c* Single Cylinder. *m* Motor.

By K. & J. Koopman, Dordrecht.

	Name of Vessel	Builders	I H P.	Press lbs.
‡‡	Neiltje	H. T. Koopman,	85	165
†	s. Hestogentosch 2	,, Dordrecht	250	190
†	Avon	,,	225	200
‡‡	Ooster Schelde	,,	90	150
‡‡	Johan Gerardus	,,	160	165

By Wilton Engineering Co., Rotterdam.

†	Freia	Bonn, Mees	400	180
†	Brenta	Duyvendyk	150	200
†	Westland	Rykee	900	180
*	Johanna Adriana	Gebr. id Mind	100	150
†	Johanna	v/d Gresen	150	200

By The Kinderdijk Engineering Works, Kinderdijk.

†	Schiller	L. Smit & Zoon	550	160
†	Zwarte Zee	T. & K. Smit	1,250	165
†	Rozenburg	,,	300	160
*	M.O.P. 18 C	,,	200	90
*	Kijkduin	,,	150	165

GERMAN.

By Actien Gesellschaft "Neptun" Schiffswerft und Maschinenfabrik, Rostock.

	Name of Vessel.	Built of	Class.	Owners	G.T. Regis	I.H.P.
†	Oora Horn	Steel	Steam	Native	2,675	1,100
†	Hornsund	,,	,,	,,	2,674	1,100
†	Harald	,,	,,	,,	2,680	1,100
	Yacht	,,	Sail	,,	—	—
†	Erika	,,	Steam	,,	2,656	1,100
†	Minna Baldt	,,	,,	,,	1,523	650
†	Dryade	,,	,,	,,	1,830	650
†	Lena Petersen	,,	,,	,,	1,521	650
†	Roma ex Mecklenburg	,,	,,	,,	2,108	900
†	Emmi Urp	,,	,,	,,	2,690	1,100

By Actien Gesellschaft "Weser," Bremen.

a	Thüringen and Lothringen	Steel	Steamer	Nordd. Lloyd	5,150ea	2,550ea
†	Orest and Pylades	,,	,,	Ges.Neptun	652ea	350ea
*	Reserve Fehmarnbelt, Norderney, Reserve Norderney and Amrumbank	,,	,,	German	380ea	160ea
a	Göben	,,	,,	Nordd. Lloyd	8,450	5,800
	Nautilus	,,	,,	Kais. Marine	—	—

By Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden.

†	G132, G133, G134, G135 and G136	Steel	Steam	German	420ea	6,500ea
†	S114, and S115	,,	,,	Ottoman	702ea	6,000ea
†	S113	,,	,,	German	9,030	16,000

By Heinrich Bradenburg, Hamburg.

*	Hermann	Steel	Steam	Native	32	150
*	Falke	,,	,,	,,	22	70
	Amtsblatt, Kreisblatt and Tageblatt	,,	Sail	,,	280ea	—
†	Wappen von Hamburg	,,	Steam	,,	235	400
	S No. 213	,,	Sail	,,	360	—

By Johannsen & Co., Danzig.

*	Zukunft	Steel	Steam	German	—	180
*	Helene, Mathilde, Margarethe and Dorothea	,,	,,	,,	—	100ea
*	Aros	,,	,,	Danish	—	190

* Compound. † Triple. †† Twin Compound. *a* Quadruple.

By R. Holtz, Harburg.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
31 vessels	Steel	Steam	Foreign	550	1,347
4 "	Wood	"		23	75
10 " (motor)	Steel			94	140
13 Lighters	"			201	
11 Lifeboats					
3 vessels (motor)			German	10	21
6 "	"	Steam	"	135	300

By Howaldtswerke, Kiel.

*	Prinz Heinrich and Prinzessin Irene	Steel	Steam	German	127ea	200ea
†	Delphin	"	"	"	300	450
m	Floating dock	"	—	"	760	
†	Mathilde	"	Steam	"	1,372	650
†	Angantyr and Bogatyr	"		Danish	1,359ea	630ea
†	Farmatyr and Veratyr	"	"	"	1,426ea	650ea
†	Secalia and Frumentia	"	"	"	2,638ea	950ea
	Kathe	"	Sail	German	29	
*	Moive		Steam	"	10	25
*	Anna			"	39	60
†	Europa and Tysk land			Danish	1,063ea	650ea
	5 Grain Elevators	"	—	German	300ea	

By D. W. Kremer & Son, Elmshorn.

	3 Lighters	Compos.		German	130ea	
*	Nikolajenosk	Steel	Steam	Russia	—	50
	Lighter			Brazil		20
					35	
		"	—	German	250	
		Compos.	"	"	140	
*	Tanger		Steam	"		90
					45	
*	Gauna				45	135
*	Yola	"	—	"	—	20
	2 Lighters				160ea	
	2 Lighters				60ea	
*	Edgar	"	—	Brazil	—	85
	2 Lighters	"	—	"	—	90ea
	Lighter	Wood	—	German	—	100
	2 Lighters	Compos.	"	"	—	60ea
	2 Lighters	Steel		French		100ea

By J. L. Meyer, Papenburg.

*	Dr. Ziegner Gmühtel	Steel	Steam	German	177	250
	Wangeroog	Compos.	Sail	"	148	—
*	Hércules and Ciclope	Steel	Steam	"	173ea	350ea
*	Atleta	"	"	"	105	250
	Timbu and Toba	"	Sail	"	448ea	—
	Tupi and Tambaya	"	"	"	340ea	—
*	Baunummer 211 and 216	"	Steam	"	7ea	20ea
	Do., 212	"	Sail	"	180	—
	Do. 213 & 214				135ea	—
*	Do. 215	"	Steam	"	20	75

By Reiherstieg Schiffswerfte und Maschinenfabrik, Hamburg.

†	Adolph Woermann	Steel	Steam	Hamburg	6,225	3,000

By Rickmers & Co., Bremerhaven.

†	R. C. Rickmers	Steel	Auxiliary	German	5,548	1,000
†	Ellen & Elizabeth		Steam	"	4,117ea	1,600ea

By Sachsenberg Bros., Ltd., Elbe and Cologne, Deutz.

*	Ernst Ludwig	Steel	Steam	Native	609	830
†	Rhenania III.	"	"	"	660	1,100
†	Raab Karcher & Co. VI.	"	"	"	675	1,200
*	Fosefina			Foreign	111	120

m Motor. * Compound. † Triple.

By Oderwerke Actien Gesellschaft, Stettin.

	Name of Vessel.	Built of	Class.	Owners	G T Regis.	I H P
†	W. C. Frohne	Steel	Steam	Native	230	300
*	D. P. II.	"	"	"	275	260
*	Aegir		"		172	300
*	Reiher		"		73	130
†	Pommern				2,100	1,100
†	Herold			"	1,450	650
*	Sassnitz				67	130
*	Mönne. Thue. Krähnig				23	50
*	Mariendorf Lankwitz				63	120
†	Diana				231	350
	Stettin III. & IV.				44	-
†	Kehdingen				256	400
†	Henny				940	450
†	Prinz Eitel Friedrich				45	100
†	Chandless			Foreign	96	180

By Schiffswerfte und Maschinenfabrik (vormals Janssen und Schmilinsky A. G.), Hamburg.

†	Goliat & Samson	Steel	Steam	Argentin	237ea	450ea
*	Andante		"	"	19	100
†	Oberbürgermeister Adiches and Seeadler	"	"	German	227ea	400ea
*	Eugen Rudenburg II.	"	"	"	17	55
†	Schleswig and Holstein				223ea	400ea
*	Zar II.	"	"	"	38	165
*	Friedrich Wilhelm				33	120
*	Dekade			Argentin	19	100
*	Sieglinde			German	45	120

By Schiffswerfte von Henry Koch, Lubeck.

†	Elsezum Bach	Steel	Steam	German	1,226	750
†	Riga				2,150	975
†	Landrat Scheiff				1,040	950
†	Russard				1,494	950
†	Ranee				868	750
†	Marie Leonhardt	"	"	"	2,522	1,000
†	Suomi				1,016	750
†	Kwong Eng.	"	"	"	1,951	1,000

By Schomer & Jensen, Tonning.

†	Maia	Steel	Steam	Flensburg	2,550	880
†	Thora Menzell	"	"	Hamburg	2,679	990
†	Rendsburg	"	"	Rendsburg	2,058	750
†	Paula Blumberg	"	"	Hamburg	1,630	780
†	Dora	"	"	Flensburg	2,650	990

By Georg. Lubeck A. G., Bremerhaven.

†	Attiku & Arcadia	Steel	Steamer	German	1,780ea	1,300ea
†	Mannheim				897	600
†	5 Trawlers		Steam		197ea	380ea
*	Favorita Vona Catalina		Steam	Argentin	495	390
†	3 Trawlers		Steam	German	245ea	400ea
†	Numfelde				194	400
†	Obotrit				168	320
†	3 Trawlers				207ea	309ea
†	Schönfels				197	390

By Joh. C. Tecklenborg A. G., Bremerhaven, Geestemunde.

a	S.S. 209 Bülow	Steel	Steam	German	9,028	6,000
†	Conrad, and Gebrüder Jürgens				207ea	350ea
a	S.S. 214 Rotenfels				5,389	3,000
†	Greta, Irmgard and Carsten				207ea	350ea
†	S.S. 218 Santa Catharina				4,200	1,600

a Quadruple. * Compound. † Triple.

By J. Thormahlen & Co., Elmshorn.

	Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
	Johanne	Steel	Sail	German	80	—
	Alster and Bertha	,,	,,	,,	75ea	
	4 Vesse's	,,	,,	,,	60ea	
m	Monsaferia	,,	—	Persia	15	
m	Peter Brandt	,,	—	German	20	
	20 Lighters	,,		,,	2,230ab	

By G. H. Thyen, Brake a/d Weser.

	Magda & Trura	Steel	Sail	Native	100ea	—

By Vulcan & Co., Stettin.

a	Prinz Ludwig	Steel	Steam	Bremen	9,630	7,000
a	Niki (Destroyers)	,,	,,	Greek	351	6,800
a	Doxa (Destroyers)	,,	,,	Gov'rnm't	350	6,800
a	Kronprinzessin Cecilie	,,	,,	Bremen	19,400	45,000

By Flensburg Shipbuilding Co., Flensburg.

	Stolzenfels	Steel	Steam	German	5,566	2,550
	Linden	,,	,,	,,	4,188	2,200
	Celia	,,	,,	,,	1,279	550
	Amstel	,,	,,	Foreign	853	650
	Ilmenan	,,	,,	German	2,614	1,050
	Eger	,,	,,	,,	2,613	1,050
	Ganelon	,,	,,	,,	3,587	1,450
	Haimon	,,	,,	,,	3,588	1,450
	Olivant	,,	,,	,,	3,841	1,525
	Durendart	,,	,,	,,	3,844	1,525
	Hagen	,,	,,	,,	4,210	2,200
	Reichenbach	,,	,,	,,	4,210	2,200
	Regina	,,	,,	,,	2,650	1,050

By Stocks & Kolbe, Kiel.

	No. 81	Steel	Lighter	Native	—	—
	Nos. 90 and 91	,,	,,	,,		—
	Nos. 92 and 33	,,	Sail	,,	—	—
*	Nos. 94, 95 & 96	,,	Steam			450
	Nos. 97, 98, 99, 103, 104, 105, 106, 107, 108 and 109	,,	Lighter	,,		—
	Nos. 110, 111, 114 and 115	,,	,,	,,	—	—

By Blohm & Voss, Hamburg.

a	Cap Vilano	Steel	Steam	German	9,467	6,400
a	König Friedrich August	,,	,,	,,	9,461	6,400
†	Nitokris	,,	,,	,,	6,149	2,800
†	Rhodopis	,,	,,	,,	7,000ab	3,100
†	Scharnhorst, large Cruiser	,,	,,	,,	11,500*d*	26,000

By C. Cassens, Emden.

	7 Vessels	Steel	Sail	German	77ea	—
*	Tony	,,	Steam and sail	,,	144	100

By J. G. Hitzler, Lauenburg (Elbe).

	Lighter	Steel	—	German	65	—
	6 Lighters	,,		,,	50ab	
	2 Lighters	,,	—	—	65ab	—
	2 Lighters	,,	—	—	215ab	—
m	Boat	,,	—	—	—	8
m	Boat	,,	—	—	—	6
	5 Lighters	,,		—	70ab	—
*	Steamer	,,		—	350	250
	2 Lighters	,,	,,	—	90ab	
m	3 Boats	,,	—	—	—	30
m	1 Boat	,,		—		12
m	1 ,,	,,	—	—	—	12
m	1 ,,	,,	—	—	—	14

* Compound. † Triple. *a* Quadruple. *m* Motor.

By Bremer Vulkan, Vegesack.

	Name of Vessel.	Built of	Class.	Owners	G.T Regis	I.H.P.
a	Freight Steamer	—	Steam	German	5,102	3,000
a	2 Passenger Steamers	—	,,	,,	6,437ea	3,300ea
*	Freight Steamer	—	,,	,,	315	200
a	2 ,, ,,	—	,,	,,	5926ea	3,000ea
†	Passenger	—	,,	,,	759	1,200
*	3 Luggers	—	,,	,,	140ea	100ea
†	2 Freight steam'rs (engines and boilers only		—			1,750ea

By C. Luhring, Brake, I.O.

	4 Luggers	Steel	—	German	100ea	—
	Heinrich	,,	Schooner	,,	125	—
	Fritz Linnemann	,,	,,	,,	136	—
	Nos. 120 & 127	,,	Lighter	,,	410ea	—
	No. 128	,,	,,	,,	279	—

By Nuscke & Co., Stettin-Grabow.

†	Auguste Levers..	Steel	Steam	German	1,968	950
†	Berlin	,,	,,	,,	503	850
*	Gerda	,,	,,	,,	42	90
	B9	,,	,,	,,	11	

By J. H. N. Wichhorst, Hamburg.

*	Krimminalpolizer	Steel	Launch	German	18	75
†	Roche	,,	,,	,,	256	400
	Ramm-Pralm	,,	,,	,,	70	—
*	Möltenort	,,	,,	,,	66	150
*	Kitzeberg	,,	,,	,,	66	150
†	Egon Vidal	,,	,,	,,	236	400
	Augustenburg	,,	,,	,,	236	400
*	Westfalen	,,	,,	,,	53	160
*	W. B. Dick	,,	,,	,,	18	60

LIST OF VESSELS ENGINED IN 1906.

By the North German Lloyd, Bremerhaven.

	Name of Vessel.	Builders.	I.H.P	Press. lbs
a	Westfalen	J. C. Tecklenborg, Geestemünde	3,000	221lbs.
a	Schwaben	Bremer Vulkan, Vegesack	3,000	,,
a	Lothringen and Thüringen	Act. Ges. Weser, Bremen	3,000ea	,,
†	Vorwärts	Bremer Vulkan, Vegesack	1,000	192
a	Prinz Ludwig	Vulcan, Stettin	7,000	221
a	Bülow	J. C. Tecklenborg, Geestemünde	6,000	,,
a	Yorck	F. Schichau, Danzig	6,000	,,
†	Ranee	H. Koch, Lübeck	700	185

DANISH.

By S. Abrahamsen, Esbjerg.

	Name of Vessel	Built of	Class.	Owners.	G.T. Regis	I.H.P.
m	Haagen	Wood	Sail	Native	43	10
m	Ane Heleni	,,	,,	,,	42	10
m	Anna	,,	,,	,,	99	28
m	Frem and Vesterhavet	,,	,,	,,	20ea	25ea
m	Stilla and Bovbjerg	,,	,,	,,	21ea	25ea

By Actieselskabet Kjobenhavns, Flydedok o.g. Skibsværft.

†	Ogir	Steel	Steam	Danish	160	425
†	Fylla and Gerda	,,	,,	,,	775ea	550ea
†	Asdang	,,	,,	Foreign	640	400

By Actieselskabet Burmeister & Wains, Maskin-o.g. Skibsbyggeri, Copenhagen.

†	Tranquebar and Nikobar	Steel	Steam	Danish	3,453ea	1,700ea
†	Kong Haakon and Dronning Maud	,,	,,	,,	1,761ea	2,500ea
	Viking	,,	Sail	,,	2,950	—

* Compound. † Triple. *a* Quadruple. *m* Motor.

By Elsinore Iron, Shipbuilding & Engineering Co., Elsinore.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
† Islands Falk ..	Steel	Steam	Danish	632	950
† Queen Alexandra	,,	,,	,,	1,282	650
† Kotonia & Boscia	,,	,,	,,	2,623ea	860ea
† Nykjobing	,,	,,	,,	918	480

FINNISH.

By Aktiebolaget Sandvikens Skeppsdockasck Mekaniska Verkstad, Helsingfors.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
a General Kondratenko and Sibirskij Strelok ..	Steel	Torpedo Cruisers	Russian	620ea	8,000ea
* Vodolej I.	,,	Steam	,,	450	370
* Haga	,,	,,	Finnish	16	120
† Emir Bucharskij and Finn ..	,,	Torpedo Cruisers	Russian	580ea	6,700ea

By the Engine & Bridge Building Co., Helsingfors.

* Lot	Steel	Steamer	Russian Gove'nm'nt	190	320

SWEDISH.

By Bergsunds Mekaniska Verkstads Aktiebolag, Stockholm.

Name of Vessel	Built of	Class	Owners	G T Regis.	I H P
* Ostana I.	Steel	Steam	Swedish	218	450
m Ursus	,,	—	Russian	185	50
† Ship No. 321 ..	,,	Steam	,,	1,278	1,300

By Eriksbergs Mek. Verkstads Aktiebolag, Goteborg.

† Fernua	Steel	Steam	Native	339	325

By Goteborgs Nya Verkstads Aktiebolag, formerly Goteborgs Mekaniska Verkstad, Goteborg.

* Slavny	Steel	Steam	Russian	68	200
† Urd	,,		Swedish	99	400

By Helsingborgs Varfs Aktiebolag, Helsingborg.

† Viking..	Steel	Steam	Swedish	826ab	475
No. 29 Barge ..	,,	—	,,	160ab	—

By Kockums Mekaniska Werkstad Aktiebolag, Malmo.

† Nord	Steel	Steam	Swedish	2,106	950

By Lindholmens Verkstads Aktiebolag, Goteborg.

† Lappland	Steel	Steam	Stockholm	1,659	1,100
† Knippla	..		Goteborg	351	300
† Oscar II.	,,	,,	Royal Swedish Navy	4,300	10,000

By The Lodose Wharf Co., Ltd., Lodose, Goteborg.

* Alma	Steel	Steam	Swedish	546	425
* Ada, Beda and Blenda	,,	,,	,,	222ea	130ea

By Motala Verkstads Nya Aktiebolag, Motala.

* Motorboat "M"	Steel	Steam	Foreign	72	130

By Oskarshamns Mekaniska Verkstads och Skeppsdockas Aktiebolag, Oskarshamns.

* Thor	Steel	Steam	Sweden	12	55
* Tatiana	..	..	,,	8	30
Hogarn No. 6 ..	,,	,,	,,	64	—

By the Stockholm Transport Co., Ekensburg.

m Tomte Matts ..	Steel	—	our own	40	32
m Stig	,,	—	,,	.	32
m Strömkarlen ..	,,	–	..	17	24

* Compound. † Triple. *a* Quadruple. *m* Motor.

NORWEGIAN.

By Aktieselskabet Fredriksstad Mek. Verksted.

Name of Vessel.	Built of	Class.	Owners.	G T Regis.	I H P.
† Kjeld & Spica ..	Steel	Steam	Norwegian	1,450ea	1,075ea
† Harry T. Inge..	,,	,,	,,	1,404	1,900
† Vitalia & Cecilia	,,	,,	,,	1,160ea	800ea
† San Lucar ..	,,	,,	,,	1,496	1,250
† Gaute	,,	,,	,,	1,400	800
Trafik 5	,,	,,	,,	125	160
† Solstad	Engines only		—		1,075

By Bergens Mekaniske Verkstad A.B., Bergen.

† Moldegaard ..	Steel	Steam	Bergen	2,735	1,280
† Skaala	,,	,,	,,	1,116	767
† Vinland	,,	,,	,,	1,287	1,030
† Jerv	,,	,,	Lynger	1,112	660
† Brisk	,,	,,	Christiania	1,642	850
† Ophir	,,	,,	Bergen	1,005	714

By Brunchorst & Dekke, Bergen.

Isrypen	Wood	Sail	Native	60	—
m Nordlyset ..	,,	,,	,,	16	10
* Liv	,,	Steam	,,	—	50
m Tihann	,,	Sail	Foreign	28	16
m Sildin	,,	,,	Native	51	20
Aslang	,,	,,	,,	22	—
m Flink	,,	,,	,,	15	8
Rebekka	,,	,,	,,	35	—
Uesa	,,	,,	,,	19	—

By Fevigs Jernskibsbyggeri, Fevig, Arendel.

† Randulf Hausen	Steel	Steam	Norwegian	1,300	900
† Virgo..	,,	,,	Finnish	1,100	800
† Vega	,,	,,	,,	800	700
† Thordis	,,	,,	Norwegian	1,700	1,100
† Maud	,,	,,	,,	2,000	1,200

By Laxevaags Shipbuilding & Engineering Co., Bergen.

† Juno	Steel	Steam	Finland	1,203	660
† Lyderhorn ..	,,	,,	Norwegian	937	660
† Saga	,,	,,	Finland	1,197	660
† Thelma	,,	,,	Norwegian	1,350	1,000

By Nylands Værkstad, Christiania.

† Gotthard	Steel	Steam	Norwegian	1,426	850
Prosper	,,	,,	,,	1,457	850
Atlantis	,,	,,	,,	1,171	700
Spiral	,,	,,	,,	1,378	850
Ulefas	,,	.	,,	1,220	650
Cassiopeia ..		,,	.	1,629	1,100
Hjorleifur and Maddoddur ..	.	,,	Iceland	112ea	280ea
Porvenir	,,	,,	Chili	260	280

By Porsgrunds Mek. Værkstad, Porsgrund.

† Otto Wathne ..	Steel	Steam	Norwegian	574	450
† Clanstad	,,	,,	,,	677	—
* Aasmund Vinje	,,	,,	,,	100	250
* Mabel	,,	,,	,,	579	350

By Stavanger Stoberi & Dok, Stavanger.

† Mauranger ..	Steel	Steam	Norwegian	1,024	650ab
† Sortland	,,	,,	,,	638	380ab
† Marietta Di Georgio ..	,,	,,	,,	905	900ab

By Trondhjems Værksted, Drontheim.

† Alten..	Steel	Steam	Norwegian	259	300
† Doore	,,	,,	,,	1,182	700
† Fordenskjold ..	,,	,,	,,	921	800
† Hausa	.	,,	,,	1,126	630
† Haakon VII. ..	.	,,	,,	1,300	1,800

* Compound. † Triple. *m* Motor.

By Akers Mek, Vœrkstad, Christiania.

	Name of Vessel	Built of	Class	Owners	G T Regis	I H P
*	Togo	Steel	Steam	Norwegian	108	360
†	Queen Alexandra	,,	,,	,,	110	360
†	Busta and Foula	,,	,,	Foreign	109ea	360ea
†	Main	,,	,,	Norwegian	110	360
†	Shinko Maru	,,	,,	,,	109	360
†	Tnazuma Maru	,,	,,	Foreign	112	360
†	Tkazuchi Maru	,,	,,	,,	112	360
†	Bygdo	,,	,,	Norwegian	1,137	750
†	Amanda	,,	,,	,,	1,170	750
†	6 Vessels (engines only.)	,,	,,	,,	—	3,670

By Christiansand Mechanical Works, Christiansand.

†	Fosen	Steel	Steam	Norwegian	273	325
†	Kvœrnes	,,	,,	,,	102	220

AUSTRIAN.

By The Austrian Lloyd, Trieste.

	Name of Vessel	Built of	Class	Owners	G.T. Regis.	I H P
†	Vorwaerts	Steel	Steam	Native	7,384	3,800

By Marco U. Martinolich, Lussinpiccolo.

†	Stefania	Steel	Steam	Ungro. Croata	175	300
	Barge: Ada	,,	,,	Tripcovich	140	—
	,, Dina	,,	,,	,,	170	—
	,, Ena	,,	,,	,,	180	—
†	Tug	,,	,,	Schwarz	60	250
*	,, Rosandra	Wood	,,	Gorup	50	110

By Stabilimento Tecnico, Trieste.

†	Istria	Steel	Steam	Austrian	270	650
†	Trieste	,,	,,	,,	159	500
	Polyphem	,,	,,	Austrian Hungarian Navy	32	120
	Destroyers Nos. 1, 2 and 3	,,	,,	,,	400ea	6,000ea
	Torpedo boats, Nos. 1, 2, 3, 4 and 5	,,	,,	,,	200ea	3,000ea

HUNGARIAN.

By Danubius Shipbuilding and Engineering Co., Ltd., Budapest, Hungary.

	Name of Vessel.	Built of	Class	Owners.	G.T Regis.	I.H P.
	L.A. Nos. 3 and 4 pontoons	Steel	—	Austrian	—	—
	Pelagos, Nora, Lena	,,	—	Greece	755ea	—
	Taac A, Alfred A	,,	—	Bulgarian	689ab	—
	Aron M, Regina and Michael	,,	—	Rumenian	705ea	—
	Tra, Zeus, Corthion, Argo	,,	-	,,	795ea	-
	K8, C14, 15, 16	,,	—	Austrian	130ab	—
	S.R.	,,	pontoon	Hungar	19	—
*	M.F.T.R. 1000	,,	paddle tug	,,	370	700
	Alice Jules	,,	Lighter	Italian	795ab	—
*	Pruth	,,	tw.-screw tug	Russian	75	130
*	Nosis Hausman	,,	screw tug	,,	67	130
	S.H.	,,	Dredger	Rumenian	89	—
	Poldi	,,	Elevator	,,	202	—

By Erste Ku K. priv Donau Dampfschiffahrts Gesellschaft, Budapest.

3 Barges	Steel	—	—	297	—
3 Barges	,,	—	—	327	—
10 Barges	,,	—	—	306	—

* Compound. † Triple.

By The Lazarus Works, Fiume.

	Name of Vessel.	Built of	Class.	Owners	G.T. Regis	I H P
*	3 Steam Tugs	Steel	Steam	Austrian Admiralty	28d ea	85ea

ITALIAN.

By Cantieri Navale di Muggiano, Spezia.

	Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
†	Muggiano	Steel	Steam	Native	4,977	2,460

By Biggio Giuseppe, Carloforte.

Moutepsni, San Marco and San Giorgio	—	Sail	Moutepsni	22ea	—
Gino	—	,,	Giovanni Biggio	18	—

By Ditta Giovanni Poli, Chioggia (Venice).

12 Barges	Steel	—	Italian	90ea	—
6 Hopper Barges	,,	—	Austrian	65ea	—
Ida, Hilda and Gina	,,	—	,,	60ea	—
Frieda	,,	—	,,	127	—
Jela	,,	—	,,	126	—

By Liguri Anconitani Dockyard, Anconi.

†	Houcenisio	Steel	Steam	Italy	4,637	2,100

By E. Moscati, Salerno.

	Corriere di Cotrove	Wood	Sail	—	71	—
	Salerno	,,	,,	—	350	—
*	Florentia	,,	Steam	—	200	180

By Officine e Cantieri Napoletani, C. and T. T. Pattison, Naples.

†	Procione, and Pallade	25-knot sea-going Torpedo boats		Royal Italian Navy	210d,ea 3,000ea
†	Cigno, Cassiopea, Calliope, Clio and Centauro	,,	,,	,,	216d,ea 3,000ea

By The Sicilian Naval Dockyard, Palermo

†	Catania and Siracusa	Steel	Steam	Foreign N.G.T.	3,187ea	2,000ea

By Societa Anonima Gio Ansaldo, Armstrong & Co., Sestri, Ponente.

†	7 vessels	Steel	Steam	Turkey	177ea	2,400ea
†	Kersagliere and Granatiere	,,	,,	R. Italian Navy	334ea	6,000ea

By Societa Esercizio Bacini, Genova.

†	Natale	Steel	Steam	Foreign	519	400
†	Virginia	,,	,,	,,	5,181	3,800

By Amerigo Gori, Leghorn.

Schooner Mario	Wood	Sail	Native	165	—
,, Emilio	,,	,,	,,	109	—
,, Marius	,,	,,	,,	109	—
,, Antonio	,,	,,	,,	110	—
,, Marina	,,	,,	,,	127	—
,, Marianna	,,	,,	,,	180	—
,, Chaira	,,	,,	,,	330	—

By Chantiers Gallinari & Co., Livourne.

Pampero	Wood	Benzine	Foreign	2	40
Fiat XII.	,,	,,	Italian	4	80
Lubrone	,,	,,	,,	2	40
Livorno	,,	,,	,,	1	24
Fust	,,	,,	,,	2	40
Chile	Wood & coppered	,,	Foreign	30	80
Itala	Wood	,,	,,	2	60

* Compound. † Triple.

By F. G. B. R. Fratelli Terrizzano, Oneglia.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis	I.H.P.
Nogi	Wood	Sail	Italian	90	—
Clamira	.	..	..	98	—
Enna Lucia ..	„	„	„	98	—
Amabile Carolina	„	„	„	90	—
Augele		..	French	17	

HONG-KONG.

By W. S. Bailey & Co., Hong-Kong.

Name of Vessel	Built of	Class.	Owners	G.T. Regis	I.H.P.
* Wo Fung	Wood	Steam	Hong Kong	115	150
Tien Kong ..	..	Motor	„	49	45 B.H.p.
* Shun Lee	..	Steam	Chinese	30	40
Lighter	.	—	Hong Kong	134	—
* Yangtse	.	Steam	Shanghai	300	330

By Hong-Kong & Whampoa Dock Co., Ltd., Hong-Kong.

* Launch Gausscock	Compos.	Steam	Manila	84	120
**Loongwo	Steel	„	Shanghai	3,923	2,900
* Launch Brilliant	Wood		Bangkok	40	80
Twelve vessels..	..		HongKong	960	
Minerva .. .	.	Sail	Vancouver	28	
No. 392	Steel	Steam	Manila	77	
††Launch Kongmoor ..	Compos.	..	Kongmoor	[illegible]	150
* Tai Tsze	Steel	.	Hong Kong	102	115
Nos. 407, 408 ..	—	.	Haiphong	701	370

STRAITS SETTLEMENTS.

By Riley, Hargreaves & Co., Ltd., Singapore.

Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
* Kinta .	Steel	Twin Screw	Federated Malay States Railways	1[illegible]	125
* Launch .	Teak	Steam	Dutch Indies	17	50
* Istan Dania ..	.	.	Singapore	20	75
* Sophia II.			Netherlands Indian G've'nme't	45	145
* Launch	„	„	Singapore	40	120
m Lighter . .	Hardwood	Motor	„	25	32 br'ke

By Tanjong Pagar Dock Board, Singapore.

* Sarawak	Wood	Steam	Foreign	120	170
* Barge ..	Steel	„	British	94	45
* In Diag and Amboina . .			Foreign	750	2100ea
* Sendawar .	..		.	18	45
* Launch . .	Wood		British	20	70
* Launch .	.	..	.	22	70
† Tug	Steel	..		320	1150
Four Barges ..	Wood	Towing		180	—
Four Barges ..	..	..	..	200	—

AUSTRALIAN.

By Adelaide Steamship Co., Adelaide.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
± Rupara . ..	Steel	Steam	British	1,398	—
† Junee . ..	.	..	..	2,132	—

* Compound. † Triple. ** Triple Compound.
±± Twin Compound. *m* Motor.

AMERICAN.

By American Shipbuilding Co., Cleveland, O., and Loraine, O.

Name of Vessel	Built of	Class	Owners	G T Regis.	I H P
† Charles E. Hebard	Steel	Steam	Native	6,294	1,760
† David Z. Norton ..			.	5,667	1,600
a Ogdensburg		..	.	2,329	1,250
a Rutland ..			..	2,321	1,250
† W. G. Pollock ..			..	4,872	1,470
† Henry A. Hawgood		..	..	6,839	1,760
† Ann Arbor, No. 4 ..			..	1,884	1,200
† Joseph Sellwood ..			..	6,741	1,600
† Loftus Cuddy ..			..	6,829	1,600
† Harvey D. Goulder .		.	..	6,617	1,760
† Henry B Smith ..			.	6,631	1,760
† J. Q. Riddle			.	6,832	1,760
† Joshua W. Rhodes				4,872	1,470
† D. R. Hanna		..	..	7,023	1,760

By F. S. Bowker & Son, Phippsburg, Maine.

Herbert May ..	Wood	Sail	Native	384	—

By The Chicago Shipbuilding Co., South Chicago.

† J. P. Morgan, H. H. Rodgers, Norman B. Ream, and Peter A. B. Widener	Steel	Steam	Native	7,053ea	1,800ea

By the Wm. Cramp & Sons' Ship and Engine Building Co., Philadelphia.

† John Weaver ..	Steel	Steam	Native	1,769	3,600
† Merida & Mexico	„	„	„	6,207ea	7,200ea
± Momus and Antilles	„	„	„	6,870ea	7,000ea
† Havana	„	„	„	6,500	8,500
± Katahdin .. .	..	..	„	2,606	950

By Detroit Shipbuilding Co., Detroit, Michigan.

Name of Vessel	Built of	Class.	Owners.	G.T. Regis	I.H.P.
† E. D. Carter ..	Steel	Steam	American	6,359	1,650
† Harry Coulby ..	..	..	..	6,495	1,900
† Sir Thomas Shaughnessy .	..	..	..	6,276	1,650
† Samuel Mather .	..	..	..	6,751	1,800
† Britannia	.	..	..	791	1,500
±±W. E. Fitzgerald	..	..	..	4,940	1,500
* Unnamed ..	„	„	..	—	6,500

By J. H. Dialogue & Son, Camden, New Jersey.

* Mariner and Haverstraw ..	Steel	Steam	Native	234ea	500ea
* Pocomoke ..	..	..	..	290	800
* Blanca	..	„	Foreign	84	300
* Florence	..		Native	20	75
United Transp. Co., Nos. 1 & 2	„	Gasoline	..	138ea	100ea
United Transp. Co., Nos. 1 & 2	„	Scow	..	140ea	—
Minerva, Catherine, and Maria	Wood	.	„	—	—
† Engine	—	—	..	—	750
±	—	—	—	.	700

* Compound. † Triple. *a* Quadruple.

By Electric Launch Co., Bayonne, N.Y.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
Arion	Wood	Gasoline	Electric	—	750
Dixie	,,	,,	—	—	200
El Fromadora	,,	,,	—	—	70
Ting How	,,	,,	—	—	100
Revonah & Katrina II.	,,	,,	—	—	50ea
Dovekie & Sis	,,	,,	—	—	25ea
Beat It, Laugh-a-Lot, Onaway and Flying Draggoon	,,	,,	—	—	50ea
Fire Fly	,,	,,	—	—	25
Mena	,,	—	,,	—	30
Rilla Josephine, Skidoo, Frances, Kenneth, Islander, Minnie B, and Cosmucoa	,,	—	,,	—	—
Bliss I, II, and III.	,,	,,	—	—	25ea

By W. & A. Fletcher Company, Hoboken, N.J.

a	Rochester	Steel	Steam	American	—	1,500
b	Ticonderoga	,,	Paddle	,,	—	1,500
t	Governor (Parsons Turbine)	,,	Steam	,,	—	4,500
**	Hendrick Hudson	,,	Paddle	,,	—	6,000

By the Fore River Shipbuilding Co., Quincy, Mass.

	South Shore	Steel	Steam	Native	874	1,200
t	Creole	,,	,,	,,	6,000est.	8,000
†	Satilla and Ogeechee	,,	,,	,,	2,667ea	1,200ea
	Cuttlefish and Octopus	,,	Elec. and Gas	U.S. Govt.	Submarine boat, Holland type.	

By the Greenport Basin and Construction Co., Greenport, N.Y.

	Impulse and Turquoise	Wood	Gasoline	American	—	40ea
†	Evelyn	,,	Steam	,,	-	300

By Hall Bros., Marine Railway & Shipbuilding Co., Winslow, Wash.

	Montana, Idaho and Anzona	Wood	-	Native	6000ea	
	Omaha	,,	-	,,	450	
†	Delhi	,,	—	,,	982	1,150

By George Lawley & Son, Corporation, S. Boston, Mass.

	Shiyessa	Wood	Sail	-		-
	Needle	,,	Naphtha	-	-	100
	Ariadne	,,	,,	-		20
	Elkhorn	,,	,,	-	—	300
	Dervish	,,	Sail	-		—
	Zirvah	,,	Aux.	—	—	25
	Savarona	Steel	,,	-	—	100
	Ermga	Wood	Naphtha	—	—	100
†	Kethoh	Steel	Steam	-	-	500
	Carmita, Paorimina, Mariel and Usona	Wood	Sail	-	-	
	Hush	,,	Naphtha	--	-	20
	Den II.	,,	,,		-	100

By The Lindstrum Shipbuilding Co., Gray Harbor, Aberdeen, Wash.

*	Quinault	Wood	Steam	Native	886	750
*	Jim Butler, Carmel and Hornet	,,	,,	,,	625ea	700ea
*	Berkeley	,,	,,	,,	546	

* Compound. † Triple. ** Triple Compound. *a* Quadruple. *b* Beam Engine. *t* Turbine.

By Manitowoc Dry Dock Co., Manitowoc, Wis.

	Name of Vessel.	Built of	Class.	Owners	G.T. Regis.	I.H.P.
	M. F. D., No. 29.	Steel	Steam	American	125	500
†	Francis T. Simmon	,,	-	—	-	1,200
	Pocantico	,,	-	—	—	150
	Stalke	,,		—	—	—
	Scows, 18 & 19	,,	—	—	-	—

By Maryland Steel Co., Sparrow Point.

*	P.R.R., No. 153.	Steel	Steam	U.S.	400	345
*	P.R.R., Nos. 5, 10 and 14	,,	,,	,,	180ea	722ea
	N.Y.P. & N.R.R. Barge No. 42	,,	Tow	,,	1257ea	—
	S. O. Co., No. 5 and No. 6	,,	,,	,,	850ea	—
†	Raleigh	,,	Steam	,,	1185	1,200
†	Tuscan	,,	,,	,,	2,500	2,800

By The Merrill Stevens Engineering Co., Jacksonville, Fla.

‡	(Floating Dock) Roosevelt	Wood & Steel	—	M. S. Co.	4,500ea	160
*	Juanita	Steel	Steam	Cuban	176	120
	La Glina	Wood	,,	,,	50	60
*	José Pedn	Steel	,,	Arg. Rep.	828	600

By Moran Bros. Co., Seattle, Wash.

†	Delhi	Wood	Steam	U.S.A.	1,091	1,000

By Newport News Shipbuilding and Dry Dock Co., Newport News, Va.

†	W. S. Porter	Steel	Steam	U.S.	4,901	2,500
*	Jamestown	,,	,,	,,	1,337	2,000
**	Ithaca	,,	,,	,,	1,462	1,400
*a**	North Carolina and Montana	,,	,,	,,Navy	14,500d.ea	23,000ea

By New York Shipbuilding Co., Camden, N.J.

	Geo. W. Capp	Steel	Dredge	Native	1,000	2,000
	Ontario and Oneida	,,	,,	,,	800ea	1,000ea
	Magnalia	,,	Oil Bge	,,	6,000Bl	300
	Two-car Floats	,,	—	—	20 cars each.	
†	President	,,		Native	5,000	5,000
	Three Coal Barges	,,	Sail	,,	3,000 each	
†	Hammonton	,,			500	500
†	Battleship New Hampshire	,,	,,	U.S. Gvrt.	16,000d	16,500

By Raritan Dry Dock Co., Perth, Amboy, N.J.

	Ook	Wood	None	Native	400	
	Butte, Tamanack & Oceolv	,,	,,	,,	450ea	—
	Eclipse and the Larchmont	,,	,,	,,	300ea	-
	Chase	,,	,,	,,	600	-

By Jas. Rees & Sons' Co., Pittsburg, Pa.

*	S. S. Brown	Steel	Steam	Native	700	800
†	Cardmas	,,	,,	Foreign	175	125

By Peter Swanson, Belvedere, Cal.

	Twilight	Wood	Gasoline	Native	12	25
	32 ft. Launch	,,	,,	,,	—	17
	33 ft.	,,	,,	Honolulu		12
	30 ft.	,,	,,	Native		25
	21 ft.	,,	,,	,,	-	5
	33 ft.	,,	,,	,,		40

By Union Iron Works, San Francisco, Cal.

**	Mexican	Steel	Steam	U.S.	8,991	3,000

By Wolverine Motor Works, Grand Rapids, Mich.

†	Skidoo	Wood	Gasoline	Native	18	50
†	Lohe	,,	Alcohol	Cuba	12	36

* Compound. † Triple. ‡ High Pressure.
** Triple Compound. *a** Quadruple Compound.

By Harlan & Hollingsworth Co., Wilmington, Del.

	Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
	Oil Barge, Silverthorn	Steel	—	Native	100	
†	Ferry Callahan	,,	Steam	,,	988	1,400
**	Light House Tender, Sunflower	,,	,,	Govt.	822	1,000
*	3 Tugs	,,	,,	Native	240ea	800ea
	3 Car Floats	,,	—	,,	2,700	—
*	2 Ferries	,,	Steam	,,	1,310ea	1,650ea
†	Wrecking Steamer Relief	,,	,,	,,	945	1,200
*	Tug, El Toro	,,	,,	,,	300	850
*	Tug, El Chico	,,	,,	,,	200	650
†	Steamer Delaware	,,	,,	,,	2,600	1,200
*	Steamer, City of Milford	Wood	,,	,,	264	350

By The Pittsburg Steamship Co., Cleveland.

†	J. Pierpont Morgan	Steel	Steam	Native	7,161	1,800
†	Norman B. Ream	,,	,,	,,	7,053	1,800
†	Henry H. Rogers	,,	,,	,,	7,053	1,800
†	Peter A. B. Widener	,,	,,	,,	7,053	1,800

By Skinner Shipbuilding and Dry Dock Co., of Baltimore City.

c	Derrick Lighter Ohio	Steel	Steam	Native	250ap	550ap
*	Tug, Baltimore	,,	,,	,,	81	350

LIST OF VESSELS ENGINED IN 1906.

By United Engineering Works, San Francisco, Cal.

	Name of Vessel.	Builders.	I.H.P.	Press. lbs
*	California	Lindstrom S. B. C.	13	
*	Cusco	Knue & Banks	430	
*	Daisy Freeman and Hoguiam	Bendixsen S. B. C.	130ea	
†	D. S. Irman, and P. S. Toop	Knue & Banks	600ea	-
*	Homer	Lindstrom S. B. C.	400	
*	F. M. Hough	Bendixsen S. B. C.	90	-
*	Tahoe and Homer Outchell	Bendixsen S. B. C.	130ea	
*	Bowden and Wellesley	C. Henckendorff	430ea	—

CANADIAN.

Collingwood Shipbuilding Co., Ltd., Collingwood.

Name of Vessel.	Built of	Class.	Owners	G.T. Regis.	I.H.P.
Ungava	Steel	Sail	Canadian	1,250	

By G. A. Cox, Shelbourne.

Reliance	Wood	Sail	Canadian	198ab	

By T. W. McKinlay, Hantsport.

Dorothy M. Porter	Wood	Sail	British	186	—

By J. Millard, Liverpool.

Hilda Vase	Wood	Sail	Canada & Newfoundland	78	—
Nita M.	,,	,,	,,	—	—
Piscamba	,,	,,	Canadian	98	-
Pindem	,,	,,	,,	200	—

By Polson Iron Works, Toronto.

†	City Dredge No. 2	Steel	Steam	British	180	200
*	Bluebell	,,	,,	,,	519	350
‡	Hercules	,,	,,	,,	233	500
‡	Snag Boat	Wood	,,	,,	131	250

* Compound. † Triple. ‡ High Pressure.
** Triple Compound. *c* Single Cylinder.

By Canadian Shipbuilding Co., Ltd., Successors to The Bertram Engine Works Co., Ltd., Toronto.

	Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
†	Cayuga	Steel	Steam	British	2,285	4,000
*	Alice	,,	,,	,,		500
†	Sagamo	,,	,,	,,		900

RUSSIAN.

By T. Eales & Son, St. Petersburg.

	Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
p	Squall	Steel	—	Russian	118d	100
*	Rabotnith	,,	Steam	,,	130	120
m	Orechekk	,,	-	,,	20	45

JAPANESE.

By Ishikawajima Shipbuilding and Engineering Co., Ltd., Tokyo.

	Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
	Kinki Maru	Wood	Sail	Japanese	149	—
*	Kamaishi Maru	Steel	Steam	,,	180	230
	Tsukuba	Wood	Sail	,,	29	-
	Daibo	,,	,,	,,	130	—
	Tenbo	,,	,,	,,	136	—
†	Iwai	Machinery only		-		300
*	Hamamashi	,,	,,	—	—	160

By Mitsu Bishi Dockyard and Engine Works, Nagasaki.

†	Joshin-Maru	Steel	Steam	Japanese	1,244	1,034
†	Masan Maru	,,	,,	,,	1,244	1,190
*	Shirasagi-Maru	,,	,,	,,	90	180
†	Hitachi-Maru	,,	,,	,,	7,500	4,200
‡	Ogasawara Maru				1,430	1,789

By Nakamuras Shipyard, Osaka.

*	Miura Maru	Wood	Steam	Japanese	380	180
	Karafuto Maru	,,	,,	,,	197	-

By The Osaka Ironworks, Osaka.

†	Asatsuyu	Steel	Torpedo Destroyer	Japanese Navy	381d	6,848
†	Hayate	,,	,,	,,	381d	6,848
†	Takamatsu Maru	,,	Steam	Japanese	1,335	1,148
†	Osumi Maru	,,	,,	,,	1,335	1,187
‡	Amoy Maru	,,	,,	,,	781	793
‡	Shiga Maru	,,	,,	,,	781	793
‡	Ryukyu Maru	,,	,,	,,	781	793
†	Hankaku Maru	,,	,,	,,	760	566

By Oaki Shipyard, Tokio.

*	No 12 Kawnon	Wood	Steam	Japanese	986	698

CHINESE.

By The Shanghai Dock and Engineering Co., Ltd., Late S. C. Farnham, Boyd & Co., Ltd., Shanghai.

	Name of Vessel.	Built of	Class.	Owners.	G.T. Regis	I.H.P.
†	Hsinkong	Steel	Steam	—	2,146	1,300
‡	Bremen	,,	Tender		321	970
*	Daisy	,,	Towboat	—	197	490
*	5 Launches	Teakwood	—	—	150	400
*	2 Launches	Steel	—	—	115	250
	Motor Oil Lighter	,,	—	—	53	—
	Motor Launch	Teakwood	—			--
	Gas Lightship	Steel	—	—	180	—
	6 Cargo Lighters	,,	—	—	1,302	—
	2 Benzine Lighters	,,	—	—	444	
	3 Pontoons	,,	—	—	18[illegible]	—

* Compound. † Triple. *a* Quadruple. *m* Motor. *p* Petrol.

By The New Engine and Shipbuilding Works Co., Ltd., Shanghai.

Name of Vessel	Built of	Class	Owners	G.T Regis	I H P
Chi-an	Steel	Pontoon	Foreign	975	—
Iris	,,	,,	,,	1,696	-
1 Vessel	,,	,,	,,	1,416	
Han-Hsing ..	,,	Lighter	,,	312	
Kiukiang No. 3	..	..	British	92	-
* 2 Vessels	Wood	Steam	Foreign	60	180
* 2 Vessels	..	Motor	,,	45	50

CHILIAN.

By Sociedad "Astillero Behrens" de Valdivia, Valdivia.

Name of Vessel	Built of	Class	Owners	G.T Regis	I H P
* Brandaway ..	Steel	Steam	Chilian	100	180
* Rio Baker ..	Wood	..	,,	75teg	100
* Fenix	Steel	..	Foreign	150 ..	180
* Rio Blanco ..	..	..	Chilian	60	150
* Tomé	..	..	..	150	150
* 2 Coastguards vess.	Wood	,,	Chilian Gvt.	25ea	65
* 5 Tug Boats ..	Steel	..	..	30/60	65/150
46 Cargo Launches	Wood	Tug	,,	35/120	-
1 Cargo Launch	Steel	—	Chilian	150	
1 Water Launch	,,	—	Chilian Govt.	150	—

WORK COMPLETED DURING THE YEAR.

ENGLISH.

Sir W. G. Armstrong, Whitworth & Co., Ltd., Elswick Works, Newcastle-on-Tyne.—Particulars of various classes of vessels built at Walker and Elswick Shipyards from 1852 to 1906:

	No.	Tonnage.	I H.P.
War Vessels	113	252,202	677,905
Passenger and Cargo Steamers	415	619,652	370,951
Petroleum Steamers	85	236,046	117,036
Ice Breakers, Dredgers, etc. ..	82	49,464	35,370
Paddle Steamers	93	24,840	29,556
Totals	788	1,182,204	1,230,818

J. T. Eltringham & Co., South Shields.—In addition to vessels launched they have built a large number of boilers for new and old steamers, and also carried out several extensive drydocking and repairing contracts. They have also constructed a large pair of dock gates.

R. & W. Hawthorn, Leslie & Co., Ltd., Hebburn-on-Tyne.—The machinery and boilers of the steamers launched, with the exception of the Cuthbert, have been built by Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., at their St. Peter's Works. The Cuthbert has been engined and boilered by the North-Eastern Marine Engineering Co., Ltd., Wallsend. In addition to the above, the St. Peter's Department have been engaged on the construction of twin-screw machinery of 16,750 I.H.P. for H.M.S. Agamemnon, and the machinery for H.M.S. Achilles and H.M.S. Attentive, representing 40,000 I.H.P., have been completed for service during the year. The engines of the T.S.S. Berlin have been removed, modified, and refitted in the ship with new boilers, and the boilers and machinery of two other large vessels have been thoroughly overhauled. The repair department at Hebburn has been very busy, and structural alterations and additions of an exceptional nature have been carried out on a number of vessels.

The Northumberland Shipbuilding Co., Ltd., Howden-on-Tyne.—It is a noteworthy fact that of the 11 vessels launched by this company 10 are of their very well-known type of 7,300 ton deadweight steamers. It might also be pointed out that 4 of the steamers are for one firm of foreign friends (making 5 in all of the same type for this firm), and 4 for one firm of London owners, and the company have at present in hand other 4 of the same type for the same London owners. The Northumberland Shipbuilding Co. are now building the forty-sixth vessel of this size and type, this being the largest number of vessels ever built off one model. It will be observed that the company have had a fairly busy year, and that the tonnage launched exceeds all previous records.

S. P. Austin & Son, Ltd., Sunderland.—In addition to the new tonnage launched as given, another vessel of about 1,700 tons gross register is ready for launching, but will be kept on the stocks till about the middle of January. Repairing work is an important feature of this Company's business and repairs of all descriptions of vessels, including hulls and machinery, have been carried out during the year on their pontoon and in their graving dock, the tonnage dealt with on the pontoon each year averaging 250,000 tons, and in the graving docks 100,000 tons

The Goole Shipbuilding & Repairing Co., Ltd., Goole.—In addition to building the vessels given in their return the firm have done a large amount of repair work to both hulls and engines of steamers.

J. Scarr & Son, Beverley and Howden, have also repaired 12 vessels at Howden.

H. Reynolds & Son, Lowestoft.—6 motor launches from 30 to 45 ft. in length.

Thames Iron Works Shipbuilding & Engineering Co., Ltd., Canning Town, E.—

† H.M.S. Black Prince (completed for sea, - launched in 1904)	Steel	Steam	Royal Navy	7,000	23,500

John I. Thornycroft & Co., Ltd., Chiswick.—

t Grasshopper ..	Steel	Steam	British	227	3,700
t Greenfly ..	,,	,,	,,	227	3,700

John Readhead & Sons, South Shields.—In addition to the hulls of vessels launched they have also built the boilers and machinery for same. The graving dock and repairing departments have also been fully occupied during the year.

Cox & Co., Falmouth.—They have also supplied new boilers and machinery to various craft, besides sundry repairs and other work.

H. S. Hansen & Co., Minerva Yard, East Cowes.—A large number of new sailing boats for H.M. Government, etc. Also repairs generally to hulls and machinery of yachts and trading vessels.

John I. Thornycroft & Co., Ltd., Woolston Works, Southampton.—Have carried out large overhauls to vessels at this port, including the extensive repairs to ss. "Deutschland."

Garston Graving Dock and Shipbuilding Co., Ltd., Garston.—Have constructed one steel tug and launch, one steel tug and tender, also several steel barges which have been shipped to the Brazils and the East, for British owners. This graving dock has been kept pretty well occupied with repairs during the year, the works also having been further brought up-to-date by the addition of pneumatic plant added to their existing electrical plant, which has been more conducive to economy.

The Welin Quadrant Davits, which are now regarded as a standard device for both passengers and high-class cargo vessels will be seen from the following table to be making great advance. In 1901 they supplied 2; in 1902, 44; in 1903, 128; in 1904, 146; in 1905, 304; and the Davits supplied or ordered between January 1st and December 21st, 1906, is 666, making a total of 1,290

Engines, etc.

The Lytham Shipbuilding and Engineering Co., Ltd., Lytham, Lancs.—

		I. H. P.
1 set 9" and 18" × 12" C.S.C. and marine boiler ..	Foreign	120
1 donkey boiler for ss. "African"	British	
1 set of 8" and 15" × 9" C.S.C. and vertical boiler ..	,,	55
1 ,, 6½" and 10" × 7" ,, ,, ..	,,	35
1 new marine boiler for trawler "Kitty" ..	,,	
1 ,, ,, "Lilly" ..	,,	—
1 set of 9" and 18" × 12" C.S.C. engines	,,	110
1 ,, 7" and 13" × 9" non-conducting engines ..	,,	40
1 set of triple engines	,,	180

* Compound. † Triple. *t* Turbine.

North Eastern Marine Engineering Co., Ltd., Wallsend and Sunderland.—Of the vessels engined at the yards, I.H.P. 73,800 was constructed at Wallsend Works, and 47,054 at Sunderland Works. The Northumberland Forge, which belongs to this company, has, during the year, turned out 3,000 tons of marine engine forgings. The output of marine engine specialities, such as feedheaters, evaporators, pumps, etc., has also been a very large one.

W. Sisson & Co., Gloucester.—A good deal of sundry marine work, and about 2,000 I.H.P., of Sisson's patent high speed self-lubricating engines and accessories.

Richardsons, Westgarth & Co., Ltd., Hartlepool, etc.—In addition to vessels engined, a large amount of miscellaneous work has been completed, including Parsons' steam turbines, "Contraflo" condensing plants, Cockerill gas engines, blowing engines, Easton & Anderson pumping engines, "Nesdrum" water tube boilers, and "Blake" boilers

The Edwards' Patent Air Pump has been fitted during the year 1906 to more than 400 Steamers, and this satisfactory total has been reached notwithstanding that during the last six months there has been a considerable reduction in the number of orders for new tonnage. The fact that the only valves used in the Edwards' Pump are readily accessible for examination and renewal renders it very reliable, and this freedom from breakdowns, together with the reduced cost of maintenance, make the Edwards' Pump a great favourite with all engineers who have had experience with it. Many of the leading marine engine builders have now standardised the Edwards' Air Pump and fit it to all the engines which they build. We may also mention that the Edwards' Pump has been fitted to over 350 electrical installations and that the total number of pumps built to date exceeds 6,100. This number includes many pumps which have been fitted for use in connection with Parsons, Curtis and De Laval turbines.

United States Metallic Packing Co., Ltd., Soho Works, Bradford, have fitted their metallic packings to the following vessels:—H.M.S.'s Agamemnon, Euryalus, Good Hope, Glory; R.I.M.S. Northbrook; H.M.S. Vengeance: H.M.Y. Victoria and Albert; Tug Goliath; H.I.J.M.S. Tenkuba; H.M.S. Melchor Ocampo; H.M.S. Almirante Grau; H.I.M.S. Otowa; H.I.M.S. Rurik; ss.'s Adventure, La Blanca, Castalia, Arratoon Apcar, Catherine Apcar, Gregory Apcar, Lightning Apcar, Japan, Nawab, Drumcondra, Herefordshire, Antony, Cuthbert, Lanfranc, Matheran, Empress of Britain, Empress of Ireland, Medomsley, Buckland, Howrah: st. Rescue; D.V. Retriever; 7 new steamers; dredger Sandpiper; ss.'s Lady Cory Wright, Star of Japan, Avon, Don Carlos, Ivernia, Lucania, Lusitania, Mauretania, Pannonia, Ultonia, Cassandra, Ulster; Launch Erin; ss.'s Albertville, Folaba, Aburi, Barranca, Chirripo, Reventazon, City of Athens, City of Delhi, City of Glasgow, Denbigh Hall, Haddon Hall, Knowsley Hall, Langton Hall, Newby Hall, Sandon Hall, Sutton Hall, Trafford Hall, Trentham Hall, Gafsa; sy. Medusa; ss.'s Newburn, Tonbridge, Winchester; ps. Grimsby; ss.'s St. Patrick, St. David, Candidate, Commodore, Wanderer, Warrior, Orator; sy.'s Marratanga, Agawa; ss.'s Antelochus, Astyanax, Bellerophon, Cyclops, Myrmidon, Memnon, Polyphemus, Titian, Hippomenes, Hermione, Hydaspes, Hylas, Hypatia, Kilcoan, Argo, Nieuw Amsterdam: sy. Hildegarde; ss.'s Ierne, Ceylon, Kelpie, Osmanieh: New Steamer: ss.'s Irwell, Mersey, Anglo-Bolivian, Africa, Lusitania; New Steamers; ss.'s Princess Ena, Ganiamore, Narrung, Servian, Manchester City, Manchester Corporation, Manchester Exchange, Manchester Inventor, Dundee, Glenearn, Lumen, Londres; ps Vienna; sy. St Serf; ss. Orari, New steamer; ps.'s Royal Sovereign, Marmion; dredger Lord Joicey; ss.'s Omrah, Mary Park; dredger; ss.'s Crown of Galicia, Rosebank, St. Patrick; stern-wheel steamer, Ardpatrick; three new steamers; ss. Warrenpoint; rms.'s Amazon, Araguaya, Dee, Octona, Tamar, Teviot, Tagus; ss.'s Begonia, Bellerby, Dromonby, Hurworth, Lackenby, Maltby, Mountby, Millpool, Newby, Ormesby, Rollesby, Troutpool, Westonby, Kildale, Skelton; sy. Maund; ps. Princess Royal; ss. Ryall; sy.'s. Minona, O-we-ra; ss.'s Lucerna, Tropea, Sir William Stephenson, Oscarl, Daffodil, Iris

Brigham & Cowan, Ltd., South Shields.—Busy on repair work

Central Marine Engine Works, West Hartlepool.—The total output of this firm is 24 sets of machinery, or an aggregate I.H.P. of 38,250, as compared with 18 sets of 34,150 I.H.P., in 1905. The whole of the machinery is of the triple expansion type. In the boiler department, besides the 49 boilers built for the engines given in list, there have been 24 built for renewals in old steamers etc., making 73 boilers in all. The forge and stamping departments have been well employed on steamer forgings, etc., during the year.

SCOTCH.

Hutson & Sons, Ltd., Kelvinhaugh Engine Works, Glasgow.—In addition to boilers for machinery of vessels launched, they have constructed other eight during the year for marine work, aggregating 220 tons.

Ross & Duncan, Whitefield Works, Govan.—In addition to boilers for the engines of vessels launched, 16 boilers have been constructed during the year of 7,200 horse power.

Hawthorns & Co., Ltd., Leith.—Throughout the year this firm have been generally well employed, both at their Leith and Granton establishments, and have carried out a considerable amount of repair work, both land and marine, embracing re-boilering, dry-docking, slipping, etc.

Lobnitz & Co., Ltd., Renfrew.—Rockcutting plants and dredging plants, shipped in pieces abroad.

Messrs. Hall, Russell & Co., Ltd., Aberdeen, have manufactured all the engines and boilers for the vessels they have built throughout the year, with the exception of the engines for the "Swallow." This firm has also done a large amount of repair work, both to the hull and to the machinery of different types of vessels, including new boilers to the ss. St. Nicholas, ss. Inyoni, and ss. Carthdee, and various kinds of other engineering work. They have also built a large diaphragm along the centre of the tunnel under the river Dee, constructed by P. Tawse, Esq., for the Town Council of Aberdeen.

William Beardmore & Co., Ltd., Naval Construction Works, Dalmuir.—Boilers for Almirante Brown for Argentine Government (battleship). 12 Gas engines of an aggregate B.H.P. of about 8500.

Bow, McLachlan & Co., Ltd., Paisley.—Paddle, screw, electric power and auxiliary engines (6390), mostly shipped abroad.

Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow.—Besides boilers for engines of vessels launched, the yachts Barmore and Mona, steamers Forth, Peterberg Harold, Cape Clear, and paddle steamer Duchess of Hamilton were re-boilered, also other boilers, aggregating 13,980 I.H.P. (19 boilers).

A. & J. Inglis, Glasgow.—Yacht Mahroussa (Khedive of Egypt) overhauled and fitted with turbine engines, I.H.P. 500.

David Rowan & Co., Glasgow.—New boilers supplied for old vessel, and for engines built by other firms, 20.

WORK ON HAND IN BRITISH YARDS.

ENGLISH.

Blyth Shipbuilding Co., Ltd., Blyth.—In addition to building berths, the Company have five graving docks and every facility for executing all classes of repairs to hulls and machinery of steamships

Hepple & Co., Ltd., South Shields.—Steel cargo steamers, 213 tons gross

Wm. Harkess & Son, Ltd., Middlesbrough.—They are building two small vessels for Messrs Elder Dempster & Co.'s Mail Bar Service, and also 1 Swedish cargo boat.

J. Scarr & Son, Beverley and Howden.—Contracts made that will last them well into next year.

W. H. Warren, New Holland.—2 lighters, 245 each; 2 sailing vessels, 170 each.

John Chambers, North Side Harbour, Lowestoft.—6 craft at present, and plenty of work to follow.

Edwards & Co., Ltd., Millwall, E.—1 tug, 1 barge, 1 floating sheerlegs

Gill & Son, Rochester.—

Barge Yacht, Alaisic	Wood	Sail	English	—	—
Barge, George Elijah	,,	,,	,,	—	—
m 2 Motor Launches	,,	—	,,	—	—
Barge (no name)	,,	,,	,,	—	—

m Motor.

H. Reynolds & Son, Lowestoft.—17 steam fishing vessels, similar to those launched, 1 motor fishing vessel, 10 cutters, galleys, gigs, pinnaces, &c., for the Admiralty.

Camper & Nicholson, Ltd., Gosport.—

Yacht	Composite	Sail	Native	85	
2	Wood	,,	,,	50 each	

R. Cock & Sons, Quay Appledore, R.S.O.—Steel screw tug, steel schooner, 144 tons gross.

Geo. & Thos. Smith, Ltd., Rye, Sussex.—2 Vessels same as Waverly, Eclipse, and Dayspring.

H. R. Stevens, Ltd., West Quay, Southampton.—

32-ft. Cutter for Admiralty	Wood	Sail	Native		
5 meter rater ..	,,	,,	,,	—	—

White Bros., Southampton.

Not Named .. (Yawl)	Wood	Sail	British	42	—

J. Samuel White & Co., Ltd., East Cowes.—

t "Mohawk" Ocean Going Destroyer	Steel	Steam	British	800 Total	15000 Total
t Also 5 Destroyers	Steel	Steam	British	2000	31000
m 2 Launches ..	,,	,,	,,	55	170

Willoughby Bros., Ltd., Plymouth.—Mooring Lighter for Admiralty for Sheerness

Isaac Pimblott & Sons, London Road, Northwich.—7 wood steam launches, 4 steel lighters

D. Williams, Portmadoc.—Have a new 3 mast schooner on stock, same size as vessel launched, her name to be B. J Owens.

Wm. J. Yarwood, Castle Dock, Northwich.—Composite lighters for Foreign, 1000 tons; steel screw steamers, Native, 300 tons; engines, 350 I.H.P.

* **H.M. Dockyard,** Portsmouth.—New Dreadnought, Steel, Steam, British Battleship, 23,000 tons.

† **H.M. Dockyard,** Devonport.—Hibernia, Steel, Steam, British Government, not known, 18,000 tons.

Baird Bros., North Shields—Quiet in new work, busy in general repairs, having several large overhaul contracts in hand. Their special steel mixture propellers are also keeping them busy having a large number of orders in hand from several large shipowning firms.

Crabtree & Co., Great Yarmouth.—3,575 I.H.P.

Davies & Co., Ltd., Lowestoft.—Five sets of compound engines about 140 I.H.P. each.

Hepple & Co., Ltd., South Shields.—Engines for steel cargo steamer, 320 I.H.P.; 2 sets disconnecting side lever paddle engines of 400 I.H.P. per pair.

MacColl & Pollock, Ltd., Wreath Quay Engineering Works, Sunderland.—Consists of 15 sets of engines of about 6,000 I.H.P. and a number of additional boilers.

Plenty & Son, Ltd., Newbury, I.H.P., 1,060, and 500.

W. Sisson & Co., Gloucester.—

*Launch for Nile ..	Salter Bros., Oxford	75		165
f Side Wheel Steamer for Chindwin River, Burmah.	,,	90		150
†Launch for J. Livesey, Esq.	N. Shepherd, Bowness, Windermere.	30		200

J. S. Vaux & Co., Sunderland.—About 400 I.H.P.

Vauxhall Iron Works, Co., Ltd., Luton.—Various sets of small marine machinery and large orders in hydraulic presses.

United States Metallic Packing Co., Ltd., Soho Works Bradford. Are fitting their metallic packings to vessels being built by the following:—Ailsa Shipbuilding Co., Ltd (2), Barclay Curle & Co. Ltd. (5), Bow, MacLachlan & Co., Ltd (1), Brown Bros. & Co., Ltd. (2), John Brown & Co., Ltd (1), Burmeister & Wains (7), Caledon Shipbuilding and Engineering Co., Ltd. (3), Central Marine Engine Works (1), George Clark, Ltd. (8), Clyde Shipbuilding and Engineering Co., Ltd (1), Denny & Co (2), William Doxford & Sons (4), Dunsmuir & Jackson (4), Elliot & Jefferv (1), Ferguson Bros. (2), Gour av Bros. & Co., Ltd. (1), J. & E. Hall, Ltd (2), Harland & Wolff, Ltd. (5), R. & W. Hawthorn, Leslie & Co. (3), D. & W Henderson & Co., Ltd. (1), Hutson & Sons (2), Lobnitz & Co. (3), North-Eastern Marine Engineering Co., Ltd. (2), Palmer's Shipbuilding and Iron Co., Ltd. (1), Ramage & Ferguson (2), David Rowan & Co. (1), David Scott & Son (1), Scott's Shipbuilding and Engineering Co., Ltd. (3), W. Simons & Co., Ltd. (1), Smith's Dry Dock Co. (1), Stephens, Alex., & Sons, Ltd. (3), John I. Thornycroft & Co., Ltd. (7), Wallsend Slipway and Engineering Co., Ltd. (5), H. Watson & Sons (1), and Workman, Clarke & Co., Ltd. (10) sets.

* Compound. † Triple. *f* Compound Non-Condensing. *m* Motor. *t* Turbine.

Beeching Bros., Ltd., Great Yarmouth.—Four vessels building

H. S. Hansen & Co., Minerva Yard, East Cowes.—A 40 ft. motor pinnace for British Navy, wood built (machinery about 80 H.P., by Messrs. Richard Hornsby & Sons, Grantham); two 56 ft. Admiralty steam pinnaces of wood for British Navy, with machinery of 200 I.H.P. each, made by Messrs. A. G. Mumford & Co., Ltd., Colchester; four sailing pinnaces, each 42 ft. long and 11 ft. beam, and a number of cutters and rowing gigs.

J. & W. B. Harvey, Littlehampton.—Two large wood lighters on hand, about 90 tons each, wood; and another vessel similar to vessel launched.

Philey & Son, Ltd., Dartmouth.—

‡‡Sea-going tug, steel....	steam	British	110	350
‡‡2 Admiralty barges, wood	,,	,,	20 ea.	80 ea.
‡‡2 river tugs	,,	Foreign	30 ea.	80 ea.
‡‡1	,,	British	25	60
Several smaller boats			25	40
			260	770

Simpson, Strickland & Co., Ltd., Dartmouth, Devon.—Several steel and wood launches in hand.

Stow & Son, Shoreham.—A wooden sailing yacht.

John I. Thornycroft & Co., Ltd., Woolston Works, Southampton.—2 coastal destroyers, 2 ocean-going destroyers, 1 cruiser yacht, 1 sea-going tug, 1 large paddle steamer and several launches.

Isaac J. Abdela, Brimscombe, Stroud.—6 steel steam launches. 2 steel Barges. 8 sets of compound engines.

Nicholson & Sons, Glasson Dock.—Have a new wood pilot schooner (sailing) for Barrow pilots building 80 ft. over all, nearly completed, but they are very busy in dry dock repairing vessels and only work at new vessels when they have nothing else to do, consequently cannot say how long it will be before launching.

H.M. Dockyard, Pembroke.—

† H.M.S. Warrior (Building)	Steel	Steam	Admiralty	—	23,500
† H.M.S. Defence (Building)	,,	,,	,,	—	27,000
† H.M.S. Aquarius (Refitting)	,,	,,	,,	—	1,100

† Triple. ‡‡ Compound Surface Condensing.

SCOTCH.

Ardrossan Dry Dock and Shipbuilding Co., Ltd., Ardrossan

1 Steel Screw Steamer	—	Steam	British		
2 Barges for Shipment	Steel	,,	Foreign	—	—
3 Tugs for Shipment	,,	,,	,,	—	

W. Chalmers & Co., Rutherglen.—Two ferries for the Argentine Government.

Ferguson Bros., Port Glasgow.—Twin screw suction hopper dredger for the Thames Conservancy Commissioners of 4500 tons gross. This vessel will have the largest tonnage of any dredger ever yet built. Twin screw tug boat for Lyttleton Harbour, New Zealand.

Fleming & Ferguson, Ltd., Paisley—

7 vessels	—	—	—	5,700	6,000

London and Glasgow Engineering and Iron Shipbuilding Co., Ltd., Govan.—One twin screw steamer of about 5,500 tons gross for foreign owners.

P. McGregor & Sons, Kirkintilloch.—1 barge, 1 cargo steamer, 4 tugs

A. Robertson, Argyllshire.—

Steam Launch ..	Wood	Steam	British	20	
Yacht	,,	Sail	,,	47	—

Scott & Sons, Glasgow.—5 steamers, total 1,300 tons.

J. Shearer & Sons, Ltd., Glasgow.—

*		Steel	Steam	Native	200ab.	275
*	Victor	,,	,,	,,	450ab.	650

J. Cran & Co., Leith.—2 new steel screw steam tugs. 8 sets engines and boilers for steam drifters.

Dee Shipbuilding Co., Ltd., Queensferry.—8 craft of various tonnage and description.

MacKay Bros., Alloa.—1 cargo steamer of 2,000 tons D.W. 3 twin screw steamers 235 ft. long.

J. Miller, Anstruther and St. Monans.—4 steam drifters.

Scott of Kinghorn, Ltd., Kinghorn.—Four Steamers: 1 for French owners; 1 large light draught steamer for South America; 1 fast twin-screw passenger steamer for Sydney owners; 1 large single-screw passenger steamer for Australian owners, with a speed of 15 knots.

Hall, Russell & Co., Ltd., Aberdeen.—3 steam trawlers, 1 steam liner, and 10 steam drifters, having a total of 1,664 tons and 4,165 I.H.P.

J. Robertson, St. Monans.—3 steam drifters.

J. Weatherhead, Eyemouth.—1 steamer, 2 sailors, and other repairing work.

The Caledon Shipbuilding and Engineering Co., Ltd., Dundee

						Caledon S & E	
†	S/S No. 191 ..	Steel	Steam	1140	British	Co., Ltd.,	2300
†	,, No. 182 ..	,,	,,	1140	,,	,,	2300
*	,, Nos. 193, 194 and 195	,,	,,	115 ea.	,,	,,	250 ea.
†	No 196 ..	,,	,,	1190	Singapore	,,	2000

Dundee Shipbuilders Co., Ltd., Dundee.—

†	1 Trawler	Steel	Steam	British	250	400
*	8 Drifters	,,	,,	,,	90	

Alex. Hall & Co., Ltd., Aberdeen.—8 vessels building with a gross tonnage of about 1,400 tons and an Indicated H.P. of about 2,500.

Add to Engines

Hutson & Sons, Ltd., Glasgow, have at present machinery in hand for 8 vessels, presently being built.

SCOTCH ENGINES, Etc.

Aitchison, Blair & Co., Clydebank.—

‡‡	——— .. .. ———	Single	400	130
†	———	3 Twin	90 ea	180 ea
		Total ..	3100	

Allan, Anderson & Co., Glasgow.—

*	2 —— ..	Montrose Shipbuilding Co ..	400 ea.	120 ea
†	- —— ..	,, ..	420	180
*	2 - — ..	Messrs. Mackie & Thomson ..	280 ea.	130 ea
*	——— ..	Do. ..	290	140

Campbell & Calderwood, Paisley.—Have a good number of orders on hand, ensuring work for some time to come.

Clyne, Mitchell & Co., Aberdeen.—

†	2 Vessels ..	John Duthie Torry Shipbuilding Co.	430 ea.	180 ea
*	— ..	Alex. Noble	155	140
†	— ..	Alex. Slater	200	180
*	— ..	W R McIntosh .. .	155	140

Colin, Houston & Co., Ltd., Kinning Park, Glasgow. 4 Sets = 1000 H P.

Cooper & Greig, Dundee.—

†	1 Set	1300 I H P ..	Home Owners	
†	1 ,, ...	1200 ,, ..	,,	

Fisher & Co., Ltd., Paisley.—

‡‡	2, Names not known yet ..	P. McGregor & Sons ..	225 ea.	130 ea
††	,, ..	Scott & Sons	330	135
††	,, ..	P. McGregor & Sons ..	140	130
		Total ..	920	

Hutson & Sons, Ltd., Glasgow.—Have at present machinery in hand for eight vessels, presently being built.

* Compound. † Triple. ‡‡ Compound Surface Condensing.

Menzies & Co., Ltd., Leith.—One set twin-screw machinery for the Ardrossan Dry Dock and Shipbuilding Co., Ardrossan. Three sets drifter machinery for the North of Scotland, as well as a large amount of other new and repair work. Prospects for next year very bright.

White & Hemphill, Ltd., Roxburgh Engine Works, Greenock.—Engines in hand, 550 I.H.P. Also large amount of repair work and general engineering.

IRISH.

Larne Shipbuilding Co., Larne.—1 vessel similar to above launched.

WORK ON HAND IN FOREIGN YARDS.

FRENCH.

The French Engineering and Shipbuilding Co., Dunkirk.—9 steamers of about 22,400 tons gross.

Augustin Normand & Co., Havre.

	Name of Vessel.	Built of	Class	Owners	G.T Regis.	I H.P
†	Braule Bas destroyers	Steel	Steam	French	350	7,000
†	Fanfare ,,	,,	,,	,,	350	7,000
†	Chasseur ,,	,,	,,	,,	430	
†	Aigrette	,,	,,	,,	60	1,400

The Provence Shipbuilding and Engineering Co., Ltd., Port de Bouc.—

†	Floride	Steel	Steam	French	835	3408
	Schneider & Co., Le Creusot, destroyer "Sape"	,,	,,	French Gov.	335	6800
	Destroyer "Galion"	,,	,,	,,	,,	,,
	Cruiser "Edgar Quinet"	,,	,,	,,	14,870	36,000
	Coastguard	,,	Steam & Sail	Ottoman Gov.	193	330

La Cie Des Messageries, Maritimes, La Ciotat.—

Sontay	Steel	Steam	Messageries Maritimes	7000	3300

BELGIAN.

Chantier Naval Anversois, Antwerp.

	Name of Vessel.	Built of	Class.	Owners	G T Regis.	I H P
†	Oehringen ..	Steel	Steam	Belgian	3,550	1,500
†	Saint Johann ..	,,	,,	,,	3,550	1,500
†	4 duplicates of St. Johann ..	,,	,,	,,	3,550	1,300
†	No. 33	,,	,,	,,	2,550	1,300

Aug. Hamman, Ostend.

One smack half made up ..	Wood	Sail	Belgian	45 to 46	

Societe Anonyme John Cockerill, Hoboken.

‡	Linga St. wheel	Steel	Steam	Foreign	28	65
*	2 Tugs	,,	,,	,,	52	30
	2 Barges	,,	,,	—	121	—
	1 Barge	,,	,,	—	178	—
	2 Barges	,,	,,	—	120	—
	7 Barges	,,	,,	—	88	—
	2 Lighters	,,	,,		56	-
	2 ,, ...	,,	,,	—	5	—
	6 Pontoons ..	,,	,,	Belgian	220 ea	—

12 Boats and Canoes of various dimensions.

DUTCH.

Wed. C. Boele & Son, Slikkerveer.

1 Vessel	Steel	Sail	Foreign	2,600	—

Gebr. G. & H. Bodewes, Martenshoek.

Irma, No. 9 ..	Steel	Sail	Foreign	200	—
Klara, No, 10 ..	,,	,,	,,	200	—
Koningin Wilhelmina	,,	Steam	Dutch	70	20
	,,	,,	,,	50	20
2 Lighters ..	,,	,,	,,	750 ea	-

* Compound. † Triple. *t* Turbine. †† Twin Compound.

Bonn & Mees, Rotterdam.

Name of Vessel	Built of	Class	Owners.	G T Regis	I.H P.
Maashaver ..	—	Steam	Dutch	3,000	1,300
Steamlighter ..	—	,,	,,	300	100
Bur	—	,,	Foreign	260	430
Magdeleine ..	—	,,	,,	260	430
Steam Trawler	—	,,	,,	261	420
Steam Trawler	—	,,	,,	265	430

Jonker, Gebr, Silmps Baumeister, Kinderdyk.

1 Lighter	—	—	-	—	1,500
1 Steam Tug ..	—	—	-	—	—
1 Tank Lighter	—	—	-	-	500

Koninklijke Nederlandsche, Grofsmederij, Leiden.

*	1 Bucket Dredger	Steel	Towed	Foreign	330	275
*	Tug	,,	Steam	Dutch	30	80

Maatschappij voor Sckeeps-en-Werktingbouw, "Fijenoord," Rotterdam.

a	Grotuis	Steel	Steam	Dutch	4,900 d	4,000
†	211	,,	,,	,,	5,400 d	1,300
†	212	,,	,,	,,	5,400 d	1,300
†	213	,,	,,	,,	5,400 d	1,300
†	214	,,	,,	,,	5,400 d	1,300

The Nederlands Shipbuilding Co., Amsterdam.

a	Vondel	Steel	Steam	Dutch	6,125	4,000
†	Vulcanus	,,	,,	,,	t2,000	1,000
	Floating Derrick	—	—	,,	—	—

J. J. Pattje & Son, Waterhuizen.

3/m Schooner	—	—	Foreign	400	I.D.W.

Rotterdamsche Droogdok Maatschappij, Rotterdam.

†	Venus & Vesta ..	Steel	-	Dutch	—	1,100ea
†	Madeleine ..	,,	—	Foreign	—	1,000
†	Suction Hopper..	,,	—	Dutch	—	600

The Royal Shipbuilding and Engineering Co., De Schelde, Flushing.

					Ship	Engines
†	Kawi..	Steel	Steam	Native	4,931	3,650
†	Zeeslang	,,	,,	,,	83	1,300
†	No. 127	,,	,,	,,	5,200	4,200
†	Heemskerck) Engines				—	6,800
†	Noordwijk) only			—	-	1,100

J. Smit Co., Alblasserdam.

†	'Haakon VII. ..	Steel	Steam	Foreign	2,100	1,100

J. & K. Smit, Kinderdijk and Krimpen, a/d Lek, Holland.

*	2 Tugboats ..	Steel	Steam	Foreign	—	200ea
†	No. 591 (Suction Dredger) ..	,,	,,	,,	—	500
	No. 593 (Floating Crane)	,,	,,	Dutch	—	50
*	Nederland I. & II.	,,	,,	,,	—	200ea
*	No. 596 (Suction and Barge unloading Dredger)	,,	,,	Foreign	—	300
*	Telegraaf VIII. .	,,	,,	Dutch	—	250
*	Havendienst IV.	,,	,,	,,	—	60
*	Nederland III.	,,	,,	,,	—	150

J. Van Aller, Hasselt.

Nos. 63 & 64 ..	Steel	Sail		160ea	—

M. Van Der Kuyl, Slikkerveer.

Argus Brenner	—	Steam	Dutch	Govt.

Van Vliet & Co., Hardinxveld.

Lighter	Steel	—	Foreign	1,810	—
,, ...	,,	—	,,	1,810	—
S.S. No. 60 ..	,,	,,	,,	800	—

* Compound. *a* Quadruple. † Triple.

Werf Conrad, Ltd., Haarlem.

Name of Vessel	Built of	Class.	Owners	G.T. Regis	I H.P.
**No. 347 (bucket & suction dredger)	Steel	—	Foreign	650	6000
**No. 354 bucket dregder..	,,	—	,,	400	250
* No. 357 gold ,,	,,	Steam	,,	—	—
* No. 358 gold ,,,	..	..	,,	—	—
m No. 359 bucket	..	..	Dutch	—	12
* No. 360 gold ,,	,,	,,	,,	—	70
* No. 361 ,, ,,	,,	,,	,,	—	70

N. V. Werf v/h Rijkee & Co., Rotterdam.

Name of Vessel	Built of	Class.	Owners.	G.T. Regis.	I H.P.
† Atlas (Tug) ..	Steel	Steam	Dutch	—	1,200
† Thames ,, ..	,,	,,	,,	—	1,200

Wilton Slipway and Engineering Co., Rotterdam.

*	No. 187	Steel	Steam	Foreign	500	500
*	No. 189	,,	,,	Dutch	75	250
*	No. 190	,,	,,	Foreign	250	250
m	No. 191	,,	Petrol	Dutch	8	20
*	No. 192	,,	Steam	Foreign	10	40

and 11 steam engines with a total of 3,400 I.H.P., and 22 marine boilers, with a total heating surface of 20,500 .

Wilton Engineering Co., Rotterdam.

† Thames Rykee	—	—	—	1,200	185

K. & J. Koopman, Dordrecht.

††	Agnes	—	—	—	350	130
†	No. 168	—	—	—	225	200
‡‡	No. 173	—	—	—	100	150
†	No. 175	—	—	—	300	190
†	No. 176	—	—	—	350	190

DUTCH.

A. J. Otto & Sons, Krimpen a d Ysel — 1 tug for the Netherlands, 4 lighters for Germany, 1 passenger steamer for the Netherlands.

P. & A. Ruztenberg, Waspik.

Tug	—		—	550	—
,, ...	—		—	1060	—

E. J. Smit & Zoon, Hoogezand.

Ideaal 2	—	—	—	1600	—
m Wilhelmshafen ..	—	—		100	20
4 lighters	—	—	—	300ea.	—

Firma A. F. Smulders, Schiedam, Rotterdam.

Type.	Destination.	I H P.	Tonnage.
Steam Hopper	Suez Canal ..	700 ..	750
3 Bucket Dredgers ..	Siam	70 ea. ..	80ea.
Bucket Dredger ..	British Account	500 ..	890
2 Hopper Barges ..	British Account	— ..	120 ea
Bucket Dredger ..	Dutch Account..	200 ..	320

W. F Stoel & Zoon, Alkmaar.—*m* 7 vessels, steel; 4 vessels, steel, sail.

Alblasserdamsche Engineering Works, Alblasserdamsche.

Name of Vessel.	Builders of Vessel.	I.H.P.	Press lbs.
Tug	—	.. 375	.. 200
Trawler.. ..	—	.. 440	.. 180
2 Dredgers ..		.. 220ea	.. 150ea
Tug	—	.. 320	.. 120
		.. 300)	
Dredgers ..		.. 150 -	.. 180
		.. 20)	
Trawler.. ..	-	.. 485	.. 200

The Kinderdijk Engineering Works, Kinderdijk.—

*	Nasm VII. ..	Bonn & Mees	150 ..	120
†	— ..	L. Smit & Zoon ..	550 ..	150
*	— ..	T. & K. Smit	180 ..	100
*	Nederland III..	T. & K. Smit	150 ..	120

** Triple Compound. * Compound. *m* Motor. † Triple.
†† Twin Compound. ‡‡ Compound Surface Condensing.

GERMAN.

Actien-Gesellschaft-Neptun Schiffswerft und Maschinenfabrik, Rostock.

	Name of Vessel	Built of	Class	Owners	G T Regis.	I.H.P.
†	S.S. 259	Steel	Steam	Native	2,670	1,100
†	,, 260	,,	,,	,,	2,690ea	1,100ea
r	,, 262, Yacht	,,	Sail	,,	—	—
†	,, 263	,,	Steam	,,	2,690	1,100
†	,, 264, 265 and 266	,,	,,	,,	2,670ea	1,100ea

Actien-Gesellschaft Weser, Bremen.

†	Gneisenau	Steel	Steam	German	8,200	26,000
a	D. 159	,,	,,	,,	5,500	2,400
a	Lützow	,,	,,	,,	8,450	5,800
†	D. 161	,,	,,	,,	340	500
	,, 162	,,	,,	,,	—	—
	,, 163	,,	,,	,,	—	—

Blohm & Voss, Hamburg.

†	Scharnhorst (large cruiser)	Steel	Steam	German Navy	11,500d	26,000
†	Rhodopis	,,	,,	German	7,000ab	3,100
†	Rhakotis	,,	,,	,,	7,000ab	3,100
a	Cap Arcona	,,	,,	,,	9,700	7,600
t	No. 195	,,	,,	German Navy	-	-
a	No. 196	,,	,,	German	10,700abt	9,200

also a Floating Dock of about 35,000 tons lifting capacity.

Flushing Shipbuilding Co., Flushing.

Name of Vessel.	Built of	Class	Owners	G T Regis	I.H.P.
Plauen	Steel	Steam	German	4,210	2,200
Neumunster	,,	,,	,,	4,210	2,200
No. 270	,,	,,	Foreign	5,580	2,550
No. 271	,,	,,	German	1,280	550
No. 272	,,	,,	,,	4,610	1,800
No. 273	,,	,,	,,	4,210	2,200

Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden.

†	S. 113	Steel	Steam	German	9,030	16,000
†	G. 135, G. 136	,,	,,	,,	420ea	6,500ea
t	G. 137	,,	,,	,,	520	10,500
†	S. 114 and S. 115	,,	,,	Foreign	702ea	6,000ea
†	S. 128	,,	,,	German	4,800	1,800
m	S. 129	,,	—	Foreign	10	30
*	S. 130	,,	Steam	,,	1,050	250
	S. 131 (100)	,,	—	German	230ea	10ea

Heinrich Bradenburg, Hamburg.

	S. No. 214	Steel	Sail	Native	15	-
*	S. No. 215	,,	Steam	,,	45	175

R. Holtz, Harburg.

	9 vessels	Steel	Steam	Foreign	176	463
	1 ,,	,,	Lighter	,,	40	—
	2 ,,	,,	Steam	German	50	112

Howaldtswerke, Kiel.

	17 steamers	—	—	—	13,556	14,125

Johannsen & Co., Danzig.

*	Railway Ferry	Steel	Steam	German	—	200

D. W. Kremer & Son, Elmshorn.

	.....	Compos.	Lighter	German	130	—
	.....	,,	,,	,,	130	—
	.....	,,	,,	,,	130	—
*	Tug	Steel	Steam	Foreign	—	90

C. Luhring, Brake, I.O.

Schooner No. 69	Steel	—	German	190	—
Lighter No, 84	,,	—	,,	280	—
Schooner No. 85	,,	—	,,	220	—

* Compound. † Triple. *a* Quadruple. *m* Motor. *r* ??? *t* Turbine.

J. L. Meyer, Papenberg.

—1 tug, 78 tons, 240 I H.P.; 1 steamer, 260 tons, 100 I.H P.; 1 ferry boat, 105 tons, 40 I.H.P.; 1 lighter, 113 tons; 1 paddle-passenger-steamer, 342 tons, 800 I H.P.; total, 898 tons, 1180 I.H.P.

Nuscke & Co., Stettin, Grabow.

	Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
†	140	Steel	Steam	German	800	450
†	142	,,	,,	Foreign	1,700	800
	143	,,	—	,,	7	—
	144	,,	—	,,	7	—
	145	,,	—	,,	7	—
	146	,,	—	German	35	—
*	149	,,	Steam	,,	100	260

Oderwerke Actien Gesellschaft, Stettin.

*	2 Passenger Steamers	Steel	Steam	Native	180	240
*	1 Ferry Steamer	,,	,,	,,	109	130
†	1 Tug	,,	,,	,,	45	160
*	1 Passenger Steamer	,,	,,	,,	105	160
†	2 Cargo steamers	,,	,,	,,	770	400
†	1 ,,	,,	,,	,,	240	250

Reiherstieg Schiffswerfte und Maschinenfabrik, Hamburg.

†	No. 421	Steel	Steam	Foreign	6,500	3,300
†	No. 422	,,	,,	,,	1,150	900

Rickmers & Co., Bremerhaven.

—About 13,000 tons gross.

Sachsenberg Bros., Ltd., Elbe and Cologne, Deutz.

†	Raab Karcher- and Co., VII	Steel	Steam	Foreign	675	1,200
*	F No. 576	,,	,,	,,	—	50
*	,, 580	,,	,,	,,	—	220
*	,, 581	,,	,,	,,	—	48
*	,, 582	,,	,,	,,	—	200
†	,, 583 Dredger	,,	—	,,	—	1,100
	No. 584 Pontoun	,,	—	,,	—	—

Schiffswerfte und Maschinenfabrik (vormals Janssen and Schmilinsky) A. G., Hamburg.

*	No. 478	Steel	Steam	German	50	135
†	Pelikan	,,	,,	,,	235	400
*	No. 840	,,	,,	,,	180	125

Schiffswerft von Henry Koch, Lubeck.

†	Teo Pao	Steel	Steam	German	1,950	1,000
*	Kanal IV.	,,	,,	,,	290	250

Schomer & Jensen, Tonning.

†	Makrele	Steel	Steam	Foreign	240	340
†	No. 71	,,	,,	,,	2,000	140
†	Dithmarschen	,,	,,	,,	240	340
†	No. 77	,,	,,	,,	240	340
†	No. 78	,,	,,	,,	240	340
†	No. 79	,,	,,	,,	240	340

G. Seebeck A.G., Bremerhaven.

†	14 Steam Trawlers	Steel	Steam	German	3,080ab	5,000ab
†	2 Tug Boats	,,	,,	,,	170	400
†	1 Cargo Steamer	,,	—	,,	530	320
†	1 Steamer for the Navy	,,	—	,,	470	200

Stocks & Koibe, Kiel.

Nos. 112 and 113.	Steel	Lighter	Native	—	—
Nos. 118, 119, 125, 126, 127, 120, 121, 122, 123	,,	,,	,,	—	—
Nos. 116, 117	Wood	Pontoons	,,	—	—
* No. 124	Steel	Steam	,,	—	300

* Compound. † Triple.

Joh. C. Tecklenborg A.G., Bremerhaven, Geestemunde.

5 Steamers ..	—	—	—	25,700	18,300

J. Thormahlen & Co., Elmshorn.

14 vessels and lighters ..	—	Sail	German	1,360	—

G. H. Thyen, Brake a/d Weser.

* S 18	Steel	Steam	Native	—	100
* S 19/20	,,	,,	,,	130ea	100
S 21	,,	Sail	,,	500	—

Vulcan & Co., Stettin.

† Pommern, Battleship	Steel	Steam	German	*12,997d	18,000
t S 270 Cruiser ..	,,	,,	..	*3,540d	13,500
a S 271	,,	,,	Foreign	9,000	7,200
a S 272 Destroyer	,,	,,	,,	350	6,800
a S 273 ,,	,,	,,	,,	350	6,800

The North German Lloyd, Bremerhaven.

a Kronprinzessin Cecilie ..	Vulcan, Stettin	45,000		213
a Kleist	F. Schichau, Danzig ..	6,000		221
a Lützow	Act. Ges. Weser, Bremen	6,000		221
a Göben	,,	6,000		221
a Washington ..	J. C. Tecklenborg, Gusmünde	13,000		221
† No. 137	J. Frerichs & Co., Einswarden	450		185
a No. 270	Schiffbau-Gesellschaft, Flensburg ..	2,800		213
† No. 171	H. Koch, Lubeck ..	950		185
† No. 172	,,	950		185

C. Cassens, Emden.—

* 3 vessels	Steel	Steam	German	144ea.	100ea

Bremer Vulkan, Vegesack —

a 2 Freight Steamers	Steam	German	5,5[illegible]ea	2,500ea
a 2	,,	,,	6,5[illegible]ea	3,000ea
4	,,	,,	7,000ea	3,000ea
* 3 Luggers	,,	,,	140ea	100ea
a Engines and boilers only				1,750

J. G. Hitzler, Lauenburg (Elbe).—

* Steamer	Steel	Steam	German	[illegible]	250
m 3 Boats	,,	,,	,,	[illegible]ab	28
m 6 ,, ...	,,	,,	,,		22

J. H. N. Wichhorst, Hamburg.—

† Estebrugge ..	Steel	Steam	German	250	420
* Stapel No. 215	,,	,,	,,	78	170

DANISH.

S. Abrahamsen, Esbjerg.

Name of Vessel	Built of	Class	Owners	G T Regis	I H P
No. Name ..	Wood	Sail	Native	42ea	25 & 7

Aktieselskabet Kjobenhavns Flydedok o.g. Skibsværft

† Building, No 62	Steel	Steam	Danish	775	550
† 63	..	..	,,	160	425
* 64	..	..	..	150	125
† ,, .. 65	,,	,,	Foreign	700	400

Aktieselskabet Burmeister & Wains, Maskin o.g. Skibsbyggeri, Copenhagen.

Nos. 254-55 ..	Steel	Steam	Foreign	3,400	1,500
Nos. 256-57-58 ..	,,	,,	Danish	7,600	4,050
Nos. 259 60 ..	..	,,	,,	5,730	2,300
No. 261	..	,,	,,	1,010	540
No. 262	..	,,	,,	310	500
No. 263	..	,,	,,	000	1,300

Elsinore Iron Shipbuilding and Engineering Co., Elsinore.

† s.s. No. 114 ..	Steel	Steam	Danish	1,550	650
† s.s. No. 115 ..	,,	,,	,,	1,250	650

* Compound. † Triple. *t* Turbine. *a* Quadruple. *m* Motor.

FINNISH.

Aktiebolagat Sandvikens Skeppsdockasck Mekaniska Verkstad, Helsingfors.

* Vodolej III. ..	Steel	Steam	Foreign	485	370

Bjornebergs Mekaniska, Werkstad.

* Hackman & Co.	Steel	Steam	Native	200	200

The Engine and Bridge Building Co., Helsingfors.

* Shallow paddle tug	Steel	Steam	Foreign	250	300
* ,, ,,	,,	,,	,,	250	300
* ,, ,,	,,	,,	,,	280	450
*Storbrotten light-ship	,,	,,	Native	370	200
* Julle	,,	,,	,,	30	75

J. D. Stenberg & Sons, Helsingfors.

* ——— ..	Iron	Steam	Native	—	140

SWEDISH.

Eriksbergs Mek. Verkstads Aktiebolag, Goteborg.

† Gylfe	Steel	Steam	Native	—	325
* Ships Aktiebolag	,,	,,	,,	—	250

Goteborgs Nya Verkstads Aktiebolag, Goteborg.

† S.S. 293	Steel	Steam	Swedish	660	400
* S.S. 294	,,	,,	,,	30	100
m S. 295 Motorboat	,,	—	,,	—	—
† S.S. 276	,,	Steam	,,	500	325

Helsingborgs Varfs Aktiebolag, Helsingborg.

† No. 30	Steel	Steam	Swedish	850ab	500

Kockums Mekaniska Werkstad Aktiebolag, Malmo.

†Prinsessan Margareta	Steel	Steam	Swedish	1,400	2,200
† Wale, Destroyer ,, ,,	,,	,,	,,	—	7,200
† Ragnard ,, ,,	,,	,,	,,	—	7,200

The Lodose Wharf Co., Ltd., Lodose, Goteborg.— One steamer similar to "Alma," 5 engines of 200 inch I H P. each

Motala Verkstads Nya Aktiebolag, Motala.

* Passenger ..	Steel	Steam	Native	—	260
† 3 Torpedo boats	,,	,,	,,	—	—

Oskarshamns Mekaniska Verkstads och Skeppsdockas, Aktiebolag.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
* 1 Vessel, 227 ..	Steel	Steam	Swedish	160ab	350
Lighter, No. 226	,,	—	,,	154	—

The Stockholm Transport Co., Ekensburg.

Liss	Steel	Motor	Own	—	—

Rob. Sjostrom, Gefle.— Machinery for new vessel of 135 I H P and 135 gross tons.

NORWEGIAN.

Aktieselsskabet Fredrikstad Mek, Værkstad.

Name of Vessel	Built of	Class.	Owners	G T Regis	I H P.
† S.S. No. 111 ..	Steel	Steam	Norwegian	1,350ab	1,000a
† ,, 112 ..	,,	,,	,,	1,425ab	1,100
† ,, 114 ..	,,	,,	,,	1,425ab	1,100
† ,, 115 ..	,,	,,	,,	1,350ab	1,400

Bergens Mekaniske, Værkstad, A.B., Bergen.—6 steamers of about same gross tonnage and I.H.P. as launched by them.

* Compound. † Triple. *m* Motor.

Akers Mek, Værkstad, Christiania.

	Name of Vessel	Built of	Class	Owners	G.T. Regis	I.H.P.
†	Anita	Steel	Steam	Norwegian	1,170ab	750
†	S.S. 246	,,	,,	,,	1,400	580
†	,, 253	,,	,,	,,	700	560
†	,, 256	,,	,,	Foreign	112	360
†	,, 257	,,	,,	Norwegian	110	360
†	,, 258, Fruit-steamer..	,,	,,	,,	1,010	800
†	,, 259, Ice-breaker .	,,	,,	,,	135ab	360
†	,, 260	,,	,,	,,	950	650
†	,, 261 Fruit-steamer..	,,	,,	,,	1,010	800
†	,, 262	,,	,,	Scotch	110	360
†	5 vessels (engines only	,,	,,	Norwegian	—	3,050

Brunchorst & Dekke, Bergen.

	Fishing craft ..	Wood	Sail	Native	20	—
	,, ..	,,	,,	,,	12	8
	,, ..	,,	,,	,,	40	-
	,, ..	,,	,,	,,	20	

Fevigs Jernskibsbyggeri, Fevig, Arendel.

†	No. 61	Steel	Steam	Norweg'n	1,700	1,100
†	No. 62	,,	,,	,,	1,500	1,200
†	No. 63	,,	,,	,,	800	400

Laxevaags Shipbuilding & Engineering Co., Bergen.

†	S.S. No. 83 & 84	Steel	Steam	Norwegian	1,100ea	660ea
†	,, ,, 85 ..	,,	,,	,,	1,050	675
†	,, ,, 86 ..	,,	,,	,,	940	660
†	,, ,, 87 ..	,,	,,	,,	1,110	700
†	,, ,, 88 ..	,,	,,	,,	1,715	900

Nylands Værkstad, Christiania.

	Eidsfas	Steel	Steam	Norwegian	1,220ab	650
	No. 171	,,	,,	,,	885	700
	,, 173	,,	,,	,,	1,000	850
	,, 174	,,	,,	,,	1,050	700
	Nos. 175, 176 and 177	,,	,,	Foreign	112ea	280ea

Porsgrunds Mek. Værkstad, Porsgrund.

*	Tugboat	Steel	Steam	Norwegian	50ab	150
†	Cargo boat	,,	,,	,,	680 ..	450
*	,, ...	,,	,,	,,	650 ..	450

Stavanger Stoberi & Dok, Stavanger.

†	S.S. No. 54 & 56	Steel	Steam	Norwegian	1,045ab ea	650ab ea
†	,, ,, 55 & 57	,,	,,	,,	995ea	900ab ea

Trondhjems Værksted, Drontheim.

†	2 cargo steamers	—	Steam	Norwegian	1,122	630
†	1 cargo and passenger steamer	—	,,	,,	280ab	260
†	1 cargo and passenger steamer	—	,,	,,	500 ,,	525

Christiansand Mechanical Works, Christiansand.—

*	4 Trawlers ..	Steel	Steam	Norwegian	100ab.	150

AUSTRO-HUNGARIAN.

The Austrian Lloyd, Trieste.

	Name of Vessel	Built of	Class	Owners.	G.T. Regis.	I.H.P.
†	No. 107 and 108	Steel	Steam	Native	3,500ea	2,800ea

Marco U. Martinolich, Lussinpiccolo.

†	1 vessel	Steel	Steam	Native	550	650
*	,, ,, ...	,,	,,	,,	130	250

Stabilimento Tecnico, Trieste.

Battleship "C"	—	—	Austr.-Hung.		
2 Destroyers ..	—	—	Navy	13,000	50,000
8 Torpedo boats	—	—	,,		

* Compound. † Triple.

Danubius Shipbuilding and Engineering Co., Ltd., Budapest.—9 lighters of about 7,900 B.R.T.

Erst Kukpru Donau Dampfschifffahrts-Gesellschaft, Budapest.

	Name of Vessel.	Built of	Class.	Owners	G.T. Regis	I.H.P.
5	Barges	Steel	—	Foreign	306ea	—
5	Barges	,,	—	,,	516ea	—

ITALIAN.

Cantieri Navale Di Muggiano, Spezia.

	Name of Vessel	Built of	Class	Owners	G.T. Regls.	I.H.P.
a	Duca degli Abruzi	Steel	Steam	Native	7,600ab	7,200ab

Duca de Genova, sister ship.

Ditta Giovanni Poli Chioggia, Venice.—2 steel sailing vessels.

Liguri Anconitana Dockyard, Ancona.

a	Regina Elena ..	Steel	Steam	Italy	7,500	7,200

E. Moscati, Salerno.

	Corriere di Calabria	Wood	Sail	—	115/101	-

Officine e Cantieri Napoletani, C. & T. T. Pattison, Naples.

†	Canopo, 25-knot sea-going Torpedo Boat ..	—	—	R. Italian Navy	210dis	3,000

And various Motor Boats, Aux. Mach. general work and repairs.

The Sicilian Naval Dockyard, Palermo.

†	Europa	Steel	Steam	Noreign	7,700	6,000
†	Roma	,,	,,	,,	7,600	—
†	Principe Umberto	,,	,,	,,	7,600	—

Societa Esercizio Bacini, Genova.

a	2 Vessels	Steel	Steam	Foreign	1,0000ea	9000ea

Chantiers Gallinari & Co., Livourne.

	XXX	Wood	Benzine	Italian	4	40
	Lysistrata ..	,,	,,	Foreign	5	60
	Peru	,,	,,	,,	1	16
	YYY	,,	,,	,,	2	40
	ZZZ	,,	,,	Italian	2	40
	Oles	,,	,,	,,	6	300
	Florio	,,	,,	,,	5	240

Amerigo Gori, Leghorn.

	Bianca Giulia ..	Wood	Sail	Native	—	—
	Dina di Lorenzo	,,	,,	,,	120	—

RUSSIAN.

T. Eales & Son, St. Petersburg.—3 barges.

AMERICAN.

The Buffalo Dry Dock Co., Buffalo, N.Y.—Large amount of repair work on hand, also 1 large tub to be used for wrecking purposes is under construction, made of steel, with all most modern appliances aboard for the purpose of wrecking, which will be launched early in the coming year of 1907; the dimensions are:—Length over all, 195 ft.; length of keel, 180 ft.; beam moulded, 43 ft.; depth moulded, 19 ft., 6 ins.; triple expansion engine.

The Chicago Shipbuilding Co., South Chicago. Contracts on hand for 5, with an average tonnage of about 1000.

† Triple. *a* Quadruple.

The William Cramp & Sons Ship & Engine Building Co., Philadelphia.

	Name of Vessel.	Built of	Class	Owners	G.T Regis	I H P.
	3 vessels, Quintard Iron Works Freighters				4,000	7,000
	South Carolina—U.S. Battleship				16,000	16,500
	Mississippi	,,			13,000	10,000
	Idaho	,,			13,000	10,000

Saratoga, Frt. and Pass. Str., 6,500 gross tons, 8,500 I.H.P., port New York.
Hull No. 348,—Pass. Str., about 6,000 gross tons, 10,000 approx. I.H.P.
Havana (see under Vessels Launched)). Will not be completed before January 1st, 1907.
Antilles (see under Vessels Launched). Will not be completed before January 1st, 1907.

Detroit Shipbuilding Co., Detroit, Mich.

*	168, unnamed	Steel	Steam	American	—	6,500
†	169, 170 and 173	,,	,,	,,	6,359ea	1,650ea
†	171	,,	,,	,,	4,940	1,500
†	172	,,	,,	,,	5,500	1,500

J. H. Dialogue & Son, Camden, New Jersey.

*	No. 411	Steel	Steam	Native	190	500
†	No. 214	,,	,,	,,	230	600
†	No. 414	,,	,,	,,	250	700
†	No. 421	,,	,,	,,	320	900

Electric Launch Co., Bayonne, N.Y.—4 60-foot steam launches, 200 h.p.

W. & A. Fletcher Co., Hoboken, N.J.

t	Yale, turbine	Steel	3-screw	Native	—	10,000
t	Harvard ,,	,,	,,	,,	—	10,000

The Fore River Shipbuilding Co., Quincy, Mass.

†	Ocmulgee	Steel	Steam	Native	2,667·17	1,200
†	Ossabaw	,,	,,	,,	2,667·17	1,200
t	Salem	,,	,,	U.S. Gvt.	3,750	16,000
†	Birmingham	,,	,,	,,	3,750	16,000
†	Hulls, Nos. 141, 142 143	,,	,,	Native	11,000d	2,500
	Viper, Submarine boat, Holland type	,,	,,	U.S. Gvt.	—	—
	Tarantula ,,	,,	,,	—	—	—

Hall Bros. Marine Railway and Shipbuilding Co., Winslow, Wash.—1 wood steamer (freight only), about 1,000 tons gross.

Harlan & Hollingsworth Co., Wilmington, Del.

†	Steamer Pawnee.	Steel	Steam	Native	2,600	1,200
†	Steamer St. Helens	,,	,,	,,	3,000	1,100
†	Lumber steamer, not named	,,	,,	,,	3,000	1,100
*	Three Ferry Boats	,,	,,	,,	4,200	6,000

George Lawley & Son, Corporation Street, Boston, Mass.

†		Steel	Aux.	–	—	500

The Lindstrom Shipbuilding Co., Gray Harbor, Aberdeen, Wash.

*	J. Marhoffer	Wood	Steam	Native	625	700
*	Claremont	,,	,,	,,	656	800

Manitowoc Dry Dock Co., Manitowoc, Wis.

*	Str. Alabama	Steel	Steam	American	1,600	2,000

Maryland Steel Co., Sparrows Point.

*	Panama Dredge No. 76	Steel	Steam	U.S.A.	2,500	—
*	Do.	,,	,,	,,	2,500	—
†	Bay Line, No. 78	,,	,,	,,	2,000	–
†	N.Y.P. & N. ,, 79	,,	,,	,,	1,352	—

* Compound. † Triple. *t* Turbine.

Moran Bros. Co., Seattle, Wash.

	Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I H.P.
†	No. 42	Steel	Steam	U.S.A.	2,499	1,300
*	,, 43	,,	,,	,,	156·7	350
†	,, 44	,,	,,	,,	443	600
†	Nos. 45, 46 and 47	,,	,,	,,	1,730ea	750ea
†	No. 48	,,	,,	,,	255·5	600

Newport News Shipbuilding and Dry Docks Co., Newport News, Va.

North Carolina and Montana (see under Vessels Launched.)

a	Minnesota	Steel	Steam	U.S. Navy	16,500d	16,500
†	Not named No.64	,,	,,	U.S.A.	—	2,000
a	,, ,, No. 65	,,	,,	,,	—	6,500

,, ,, Nos. 66-7-8. Three Steel Car Floats.—U.S.A.
,, ,, Nos. 69-70-1-2-3-4). Six Steel Dump Barges, U.S.A.
,, ,, No. 75. Dredge, Hull. U.S.A.
Lengthening Old Dominion Steamer, Jefferson, U.S.A.
,, Merchants and Miners Essex ,,
,, Pilot Boat, Relief, Virginia Pilots Association, U.S.A.
Steamship St. Paul, New Boiler Plant.

New York Shipbuilding Co., Camden, N.J.

Battleship Kansas, ready for official trial.
,, New Hampshire, fittings out.
,, Michigan, keel laid.
† Twin-screw Steamship, Governor, 416 × 48 × 30, 5,000.
† Single-screw Steamship, 285 × 46 × 18, 1,500, 2,000.
5 Single-screw Light Ships, U.S. Govt., 115 × 286 × 22, 650 tons, 400 I.H.P.

The Pittsburg Steamship Co., Cleveland.—4 steamers all duplicate of vessels launched.

Raritan Dry Dock Co., Perth Amboy, N.J.—2 scows.

Peter Swanson, Belvedere, Cal.—2 vessels, 34 ft. and 38 ft., of 25 and 30, I.H.P. respectively.

Skinner Ship Building & Dry Dock Co., Baltimore.

*	3 Tugs	Steel	Steam	U.S.A.	200ap.ea	700ap.ea

Union Iron Works, San Francisco, Cal.

*	T.S.S. Columbian	Steel	Steam	U.S.	8,991	3,600
†	S.S. Isthmian	,,	,,	,,	5,224	2,750
†	S.S. Maunakea	,,	,,	,,	1,549	2,200

Launched, not delivered.

**	Californiia, Armoured Cruiser	Steel	Steam	U.S.N.	—	23,000
**	South Dakota ,,	,,	,,	,,	–	23,000
**	Milwaukee ,,	,,	,,	,,	—	21,000

United Engineering Works, San Francisco, Cal.—

Conversion of Steamer Koichak into Oil Burner.
,, ,, ,, Sequioa ,, ,, ,,
,, ,, ,, North Fork ,, ,,

CANADIAN.

Canadian Shipbuilding Co., Ltd., Toronto.

	Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
**	———	Steel	Steam	British	—	1,800
†	———	,,	,,	,,	—	3,000
a	———	,,	,,	,,	—	1,850
	2 Scows	,,	–	,,	—	—
†	———	,,	,,	,,	—	280

Collingwood Shipbuilding Co., Ltd., Collingwood.

†	Midland Prince	Steel	Steam	Canadian	5,975	1,750
†	New Vessels	,,	,,	,,	5,200	1,600

Davis' Dry Dock. Kingston.—Contracts for 2 steamboats and 2 gasoline boats. Several orders coming, not yet closed.

J. W. McKinlay, Hantsport.—1 schooner to build.

* Compound. † Triple. *a* Quadruple.

Polson Iron Works, Toronto.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
Dump Scows .. 1 and 2	Steel	Tow	British	500 cubic yard capacity each.	
Dredger Dipper 82	,,	Steam	,,	5 cubic yard capacity.	
* Car Ferry ..	,,	,,	,,	1,760	1,600

HONG KONG.

W. S. Bailey & Co., Hong Kong.

Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
m Motor Boat ..	Wood	—	Chinese	25ap.	28
* Steam Cutter ..	,,	—	,,	10	20
m Motor Boat ..	,,	-	,,	42	48
Oil Barge ..	Steel	-	,,	40	
Water Boat ..	Wood	-	Foreign	65	—
2 Towing Barges	Iron	—	Chinese	150ea	
* Steam Launch..	Wood		,,	30	40

CHINESE.

The New Engineering & Shipbuilding Works, Ltd., Shanghai.

Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
* 1 Vessel	Steel	Steam	Foreign	250	250

The Shanghai Dock & Engineering Co., Ltd., Shanghai.

† Kian	Steel		—	1,217	700
Pontoon	,,	—	—	182	—

JAPANESE.

Ishikawajima Shipbuilding & Engineering Co., Ltd., Tokyo.

Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
One	Steel	Steam	Japanese	900	—
2 Vessels	,,	,,	,,	200ea	-

J. Meyers Shipbuilding Co., Zalt Bomince.—Lighters and sea going cargo passenger steamers

Mitsu Bishi Dockyard Engine Works, Nagasaki.

t Yard Nos. 190 & 191	Steel	Steam	Japanese	13,500ea	16,500e
t Yard No. 194 ..	,,	,,	,,	3,700	8,500
† Yard Nos. 195, 196, 197 & 198	,,	,,	,,	5,600ea	7,300ea

Nakamuras Shipyard, Osaka.

Two of the Wooden Steam Launch.
Steel Steamer of about 185′×23′ 6″×21′ 6″, of moulded dimensions. (Materials ordered.)

Oaki Shipyard, Tokio.

* Cargo Boat, No.1 Kayomaru ..	Wood	Steam	Japanese	995ab	1,200
Dredger	,,	,,	,,	48ab	160

The Osaka Iron Works, Osaka.

† Miyazaki Maru, Oita Maru, Beppu Maru, Matsuye Maru ..	Steel	Steam	Japanese	670ea	—
† Yard No. 504 ..	,,	,,	Foreign	500	—
* ,, 506 ..	,,	,,	Japanese	70	—
† ,, 508 ..	,,	,,	,,	1,650	—
† ,, 509 ..	,,	,,	,,	1,650	—

* Compound. † Triple. *m* Motor. *t* Turbine.

CHILI.

Sociedad "Astillero Behrens" De Valdivia, Valdivia.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
* 4 Tug-boats ..	Steel	Steam	Chilian	—	80/175
42 Cargo-launches	Wood	—	,,	—	—

STRAITS SETTLEMENTS.

The Tanjong Pagar Dock Board, Singapore.

Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
Steamer	Steel	Steam	—	85	160

AUSTRALIAN.

Adelaide Steamship Co., Adelaide.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis	I.H.P.
Echunga	Steel	Steam	British	796	—

Walkers, Ltd., Maryborough.—Minor repair work only.

Lloyds' Register.—Mr. Charles Buchanan, we are informed, has been appointed one of the assistants to Mr. H. J. Cornish, chief ship surveyor to Lloyd's Register, in consequence of the retirement through ill-health of Mr. George Stanbury, senior assistant. Mr. Buchanan, who hails from Dumbarton, has a very intimate knowledge of the work of a classification society. He was chosen as a surveyor in 1880, and for several years has been a principal surveyor on the staff of the chief ship surveyor. Mr. Buchanan has served at various outports, but the greater part of his time has been served in London.

"Tynos" Removable Asbestos Mattresses.—Messrs. S. T. Taylor & Sons, of Scotswood, Newcastle-on-Tyne, are supplying their "Tynos" patent mattresses for covering the 25 boiler bottoms in the Cunard steamer *Lusitania*. They have branches on the Clyde and at Cardiff, and in connection with the Clyde work, although competition naturally is very keen, yet they have done a considerable amount of marine work, all of which has given absolute satisfaction to the marine and superintendent engineers. Their patent mattresses have been used on the boiler bottoms of all the Clyde jobs, and they have also carried out the other portions of the work with their own men. They have a fair amount of work booked ahead for the Clyde, and the outlook is very hopeful for Clyde work.

A Lecture on "Canada," illustrated by lantern views, was delivered at the Institute of Marine Engineers by Mr. Graydon Hume (member) on Monday, Nov. 19th. The history of Canada was briefly touched upon and the mineral and agricultural wealth of the country was pointed out, with other features, which showed the Dominion to be a desirable ground for those who wish to develop their energies and have something to show for it.

Association of Engineers in Charge.—On the afternoon of December 1st the members of the Association of Engineers in Charge visited the engineering department of the Houses of Parliament. They were met at the Chancellor's Gate by Mr. Patey, the Resident Engineer, who conducted them throughout, and whose courtesy in replying to questions, added to his lucid explanations, enhanced greatly the interest of the visit. The members were shown the whole of the ventilating system, from the inlets on the famous terrace, through the washing and fog filtering screens, and the warming and equalizing chambers, to the floor of the debating chamber itself. Tney were also shown the lighting arrangements of the chamber, the forced draught system for carrying off the smoke of the huge pile of buildings, which has been built without using the ordinary method of a separate chimney for each room, thus adding greatly to their external beauty and the system of sewage disposal.

* Compound.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

THE total output of new shipping produced by Clyde and Scottish shipbuilders during 1905 amounted to about 540,000 tons and formed a record, but the figures available at date of writing, for the year now closing, show an increase of over 38,000 tons where the Clyde district is alone concerned, and of approaching 44,000 tons for the whole of Scotland. Not only so, but a large number of the smaller class of vessels, and the light-draught class usually shipped abroad in pieces, which do not figure in any monthly statements, fall to be included in the complete returns for the year, so that by the time the full account of the whole year's work is made up, both the number of vessels and the aggregate tonnage will be somewhat higher than is here estimated, and very considerably higher than for any previous year. There seems every likelihood of the year's grand total of Scottish shipbuilding reaching the unprecedented figure of close upon 600,000 tons. Huge ships have, of course, formed a feature of the year's work and account to some extent for the record output, but as an offset to this, the seven weeks' strike of the iron shipbuilding sections of the Clyde shipyards falls to be considered. Elsewhere in this issue, full and detailed statistics are given of the work accomplished both as regards ships and their machinery, so that nothing more need be stated here.

Since the beginning of December, shipbuilders on the Clyde and in other Scottish districts have experienced a quickening of inquiry for new tonnage and a number of more or less important contracts have been arranged.

Messrs. Wm. Simons & Co., Ltd., Renfrew, have received orders for a dredger and two hopper barges for foreign owners. The vessels are to be constructed to the classification of the *Bureau Veritas*.

Messrs. Ferguson Brothers, Port Glasgow, have received from the High Commissioner of New Zealand an order for a powerful twin-screw tug for service at Lyttleton Harbour, New Zealand. This firm has at present on hand a suction hopper dredger for the Thames Conservancy Board of no less than 3,500 tons capacity, the contract price for which is £71,750. They recently handed over, after most satisfactory trials, the bucket dredger *Fleetwood* to her owners, the Lancashire and Yorkshire and London and North-Western Joint Railway Companies. This vessel is of the bow-well centre bucket ladder type, and is designed to raise 900 tons per hour. On trial she raised as much as 1,150 tons per hour, and obtained a speed of 7½ knots, being half a knot in excess of the contract.

Messrs. Wm. Hamilton & Co., Port Glasgow, have contracted with the Hamburg-America Line to build a large twin-screw steamer, the engines for which will be supplied by Messrs. Muir & Houston.

Messrs. A. Rodger & Co., Port Glasgow, are reported to have contracted to build for Messrs. John Denholm & Co., Bo'ness, a steamer for the Baltic trade with a deadweight capacity of 1,700 tons. The engines for this vessel will be made in the firm's own engine works in Helen Street, Govan, which have had a goodly output of work during the year, concerned not only with marine engines, but with gas engines and gas producer plant of the firm's own manufacture.

Messrs. Scott's Shipbuilding and Engineering Co., Greenock, have contracted to build and engine three steamers, each of 7,600 tons deadweight capacity, and for foreign owners they have contracted to build five lighters, each of 800 tons carrying capacity.

The Caledon Shipbuilding and Engineering Co., Dundee, have received an order from a Singapore Shipping firm for a steamer of 1,500 tons.

The Dundee Shipbuilding Co. have contracted for a sixth steam drifter for East Coast owners, five other vessels of this class being at present on hand. The demand for drifters and other such steam craft by the fishermen of the Fifeshire coast is much on the increase. Mr. James Miller, of Anstruther, launched on the 1st December a steam drifter, 85 feet long, to the order of Messrs. Gardner, Cellardyke. This is the second drifter launched from this yard since September, and orders are on hand for others of the same size at a cost of £2,500 each. At Anstruther alone, about a dozen new steam drifters are being built, or are on order.

Invitations to tender for the construction of the machinery for the two new battleships of the Dreadnought type, to be laid down in the dockyards, have been sent to no fewer than seventeen firms throughout the kingdom, six of whom are on the Clyde. These are: Messrs. Beardmore & Co., Dalmuir; Brown & Co., Clydebank; Denny & Co., Dumbarton; Fairfield Co., Govan; London & Glasgow Co., Govan, and Scotts' Co., Greenock. Heavy penalties are to be exacted for late delivery of the machinery for these vessels, as also for delay in the completion of the Dreadnought to be built in a private yard, the amount being £100 per day beyond the two years. In the case of the two dockyard ships, the machinery is to be completed by October, 1908, and for excess of weight in the machinery for all three ships, a penalty also is to be imposed.

Messrs. Yarrow & Co.'s new works at Scotstoun on the Clyde are now in a well-advanced stage, the work of laying out the yard and constructing dock and workshops having been accomplished with considerable despatch, although it was only on the 10th ult. that the plans of the works were formally approved by the buildings committee for the First or Upper District of the County of Renfrew. The plans lodged and approved embraced the erection of a number of new buildings, including engineering works, shipbuilding yard and tidal basin. The firm hope to be able to commence, not very long after the New Year, the construction of light draft and high-speed craft, including their particular specialities in the way of torpedo craft, of which they have turned out many of wonderful speed for both the British and foreign navies. They will also, at their new works, make their well-known water tube marine boilers. This latest addition to Clyde shipbuilding yards should bring employment to a fairly large body of men.

Messrs. John Shearer & Sons, whose new shipyard and graving dock are adjacent to the new Yarrow works, are now preparing the building berths and shipyard sheds in view of a proper start there when they leave their present yard at Kelvinhaugh shortly, the site being now required by the Clyde Trust in connection with the new dock works, etc. to be carried out at Yorkhill. While the new works at Elderslie, so far as shipbuilding operations are concerned, have not, up till the present, been in operation, the graving dock has been very largely requisitioned for the overhaul of steamers large and small.

Messrs. Dobbie, McInnes, Ltd., have experienced, throughout the year 1906, a very active sale for all kinds of steam and gas engine indicators of their well-known patent make. To meet such demand, the capacity of the firm's works at Govan has been practically doubled. There has also been a good demand for the "Messenger" apparatus for testing the circularity of boiler furnaces.

Messrs. John Hastie & Co., Greenock, have been kept well employed with the manufacture of steam and hand-steering gears. Amongst other important vessels which they have supplied with steam steering gear, are the Imperial Russian cruiser, *Rurik*; the Royal Mail Steam Packet Company's steamer, *Araguaya*; the Pacific Steam Navigation Company's *Oriana*; the New Zealand Steamship Company's *Orari* and *Opawa*; the Donaldson Line steamer *Cassandra*; Patrick Henderson & Company's steamer *Ava*; the British India steamers *Chupra* and *Chanda*; the Hamburg America steamer *Brazilia*; the Leyland Line *Anglian*; also a large number of other smaller vessels. Prospects for the coming year are good, and amongst other important orders on hand are steam steering gear for His Majesty the King's new turbine yacht *Alexandra*, steam steering gear for the new vessels building for the Anchor Line, the Allan Line, the City Line, the British India Company, Fratelli Cosulich, Bucknell Bros., and a new fleet for the Lloyds Brazeliero.

The vacancy in the Clyde Trust caused by the death, on the 19th ult., of Mr. James Rowan, of Messrs. David Rowan and Sons, Engineers, has been filled by the appointment of Mr. James Gilchrist, chairman of Messrs. Barclay, Curle and Co., Engineers and Shipbuilders, Whiteinch. Mr. Gilchrist

is a brother-in-law of Mr. Rowan and President of the Institution of Engineers and Shipbuilders in Scotland.

The Clyde Trust have decided to adopt a recommendation of their Committee on New Works that Elderslie Rock should be removed to a greater width than was originally contemplated under the contract, which is nearing completion. The contract bottom-width of 200 feet is to be increased by taking 30 feet more off the north side at an additional cost, at the present contract rates, of about £5,000. The contractor being still on the spot, with all his special plant, it will be convenient to increase the bottom-width of the channel, and so to remove a barrier which has long been a source of trouble to the Trustees and to navigation.

Amongst the engineering schemes in Scotland for which sanction is to be sought during the ensuing session of Parliament are several in connection with new harbours and docks. The Clyde Navigation Trust propose to construct a wharf, 1,860 feet long on the north side of the river, about four miles below the present harbour proper. The site is the only one available on the north side of the river for a distance of ten miles below the harbour, which in itself bears evidence of the great industrial development on the river. At Leith, the Harbour and Dock Commissioners propose to construct a graving dock entering off the existing Imperial wet-dock, which will be 575 feet long and have an entrance 70 feet in width. On the Fifeshire coast in view of the quickened mining industry, the existing harbour at Buckhaven is to be extended and improved with a view to sharing in the coal export trade. A new dock, 9 acres in extent, is to be built with an 80 feet entrance, and in addition there is to be a jetty of open-work, with sea-walls, embankments and an entrance channel. Railway connection will be made with the system of the North British Company.

THE TYNE.

(From our Own Correspondent.)

Shipbuilding. Last year we were able to record an opinion about the condition of the shipbuilding industry which was not in any way expressive of doubt: there were indeed present too many indications of approaching prosperity to render any opinion out of place excepting one of confidence in the future. This year, however, the situation is different. The brisk time that was looked forward to a year ago has most assuredly made its presence felt; but during the autumn a slight change for the worse has been experienced, and at the time of writing another change seems imminent. The substantial advance that has taken place in the prices of ship and boiler plates is a convincing proof that shipbuilders have received orders, and indeed specific particulars have been published of many contracts recently negotiated. On the other hand, there is the incontestable fact that the tonnage output this year will prove to be a record one, in which foreign shipbuilding establishments will take up a larger share than ever they have done before. It is scarcely to be doubted that, so far as shipbuilding is concerned, the productive resources of the world are already a good deal in excess of requirements, and though at present things are quite lively in the majority of British yards, the conviction forces itself on the minds of disinterested outsiders that this satisfactory state of matters cannot long be maintained. We note with pleasure that the North-East Coast yards still continue to hold a good share of foreign business in shipbuilding, and we may be absolutely certain that shipowners of other nations would not come to England for vessels if they could get supplied on equally advantageous terms, at home. It should be our endeavour to hold what we have of foreign trade, and if possible, to get more of it, and this can be accomplished by the elimination of dispute stoppages, and the adoption of all known accessories by which the cheapening of production can be helped.

The Tyne has had a complete immunity from disputes this year, and in that respect has enjoyed a distinct advantage over the Clyde and the Tees districts, where sectional strikes have caused much trouble. No doubt the advantages of uninterrupted work will be shown in the output returns, which this year bid fair to largely exceed those of any other district. The great event of the year was, of course, the launching of the S.S. *Mauretania*, the measurement capacity of which is in itself quite sufficient to make a satisfactory year's output, from almost any yard. The launch of the battleship *Lord Nelson* was also an event of note, and the managers of the great Jarrow establishment have cause to be proud of the circumstance that this vessel was got off the stocks in considerably less than the prescribed period. A large force of men are now engaged on the ship, and every possible effort is being made to finish the details of construction both internally and externally and there is no reason to doubt that unprecedentedly quick delivery, for a vessel of this type, will be made possible. We are pleased to hear that the eminent firm who have contributed this latest addition to our naval force have secured some good mercantile orders lately, and are likely to commence the new year under very favourable conditions.

The builders of the *Mauretania* have also secured some further work, and will enter upon the coming year with their berths well filled and the complements of men in the various departments brought up to full force. The firm launched a fine vessel during the month for the Shaw, Saville and Albion Copmany, Ltd., and have now one or two more about ready for putting into the water.

Messrs. Armstrong, Whitworth & Co. have booked orders for their Low Walker yard, and their Elswick establishment is daily becoming busier. Messrs. Wood, Skinner & Co. have their berths well filled, and at Messrs. Hawthorn, Leslie & Co.'s yard there continues to be a good deal of work in hand. Messrs. Robt. Stephenson & Co. have booked orders lately, and their large graving dock has been constantly engaged during the past three months.

The Northumberland Shipbuilding Company have all their available building space taken up, and the Tyne Shipbuilding Company have vessels under construction in each of their three building berths. The Smiths' Dock Company have received some additional orders for fishing vessels, and they have many contracts for repair work in hand. The Commercial Dry Dock Company are also having orders in hand, and their extensive accommodation is being fully utilized.

Engineering.—The Tyne Commissioners are distributing a pamphlet descriptive of the advantages afforded for the development of enterprise between those busy centres, Newcastle and Shields. The North-Eastern Railway Company has lines in close proximity to the river on both sides, and the waterway itself is one of the finest in the kingdom. Owing mainly, perhaps, to the decadence of the chemical industry there are many sites on the river, well worthy of the attention of manufacturers who may contemplate removing from other centres, or who may be engaged in initiating new enterprises. All these sites are most favourably placed for the economical delivery of fuel supplies, and there is now no place on the Tyne where electrical plant cannot be installed and supplied with current on highly favourable terms.

In the marine engine works business continues brisk, the Wallsend Shipway Works, the St. Peter's Works, and the North-Eastern Works being perhaps the most conspicuously active. The Wallsend firm have carried out several important repair contracts this year, and the new work in hand is of an exceptionally important kind. Messrs. Parsons' turbine works at Wallsend and Walkergate are exceedingly busy, and likely to continue so, as orders are still being booked. Messrs. Donkin & Co., and also Messrs. Henry Watson & Sons are well supplied with work, and in both cases full complements of hands are kept on. Messrs. Holmes's electrical works are busy, ship-lighting being still the firm's speciality. Messrs. Clark, Chapman & Co. are well off for work in their special lines, and at Messrs. John Abbot & Co.'s works the state of business is satisfactory. Steel works at Jarrow, Newburn and Consett are kept actively going, and copper works, brass works and foundries continue to do well.

THE WEAR.

(From our Own Correspondent.)

Shipbuilding.—An advance of 1s. per week on time wages and 5 per cent. on piece prices has been awarded to the joiners, shipwrights, painters, and drillers in the Wear

shipyards, through the medium of an arbitration court appointed under the rules of the Conciliation Board, to which those sections are attached. The members of the Boilermakers' and Iron Shipbuilders' Society chose to remain aloof, and so are left without an advance, though they applied for one a couple of months ago. This, we believe, is the first time in the history of the trade that the sections mentioned have received an advantage that was not shared in by the boilermakers ; and it is to be hoped that the incident will teach the latter body a needed lesson in humility. It would, however, be interesting to learn on what grounds the umpire in this case accorded an advance of wages to any section, as all experts agree that there is no ground for advancing wages at this juncture. The mischief is done, however, and though no one will begrudge the men what they receive, the chances are that the concession will ultimately do them more harm than good, as orders may be diverted to other districts where the wages have *not* been advanced, and where accordingly shipbuilders may cut their quotations to a finer point.

At the time of writing the output returns of shipbuilding for 1906 have not been published ; but more than one contemporary has stated within the past few days that Messrs. Doxford will head the list this year, with something upwards of 100,000 tons. Three months ago the opinion was given in these notes that that result would be attained, and we cannot but feel gratified that our forecast is now pretty certain of fulfilment. It is known that Messrs. Doxford have added to their order list lately, and unless some untoward event occurs to upset all calculations, it is pretty certain that in the coming year they will go so far as to outdistance even the splendid achievement of the present year.

Messrs. J. L. Thompson & Sons will also have a very large output this year, and will probably be second on the list, so far as the Wear is concerned. This firm, however, have only five berths as compared with Messrs. Doxford's six, and they have no overhead network of girders for the facilitating of electric crane travelling. Messrs. Robt. Thompson & Sons are said to have received orders for three boats from a Middlesboro' firm of owners, and it is also stated that Messrs. Osborne & Graham have booked orders.

Messrs. Short Bros. have been complimented by Lord Charles Beresford on the superiority of the workmanship and material in the S.S. *Coronation*, which vessel came under his notice when being docked at Malta, after receiving damage on the Mercanti Rocks. The S.S. *Coronation* was built by Messrs. Short Bros. in 1902.

Messrs. Sir James Laing & Sons have completed their great scheme of extension and development, and the yard is now thoroughly up to date in the matter of productive resources. Messrs. S. P. Austin & Sons have had a busy year, especially in new work, of which they have still a good deal in hand.

Engineering.—The marine engine works are still well off for orders, and in the smaller works a steady business continues to be done. Electrical works are kept actively going, and at several of the foundries an improvement is noticeable. Local iron works continue to run full time, and brass and copper works are having a fair share of work.

MERSEY AND MANCHESTER SHIP CANAL

(*From our Own Correspondent.*)

THE new dry dock at the Manchester Ship Canal is almost completed. The gates are in position. The entrance from the Canal has yet to be cleared and dredged, but it is expected to be opened by the middle of the present month. The increase of shipping and the growth of larger vessels navigating the canal has led to the determination on the part of the directors of the Manchester Dry Docks Co. to extend No. 1 dock permanently. The time for this extension is opportune, owing to the contractor's plant being on the ground. The extension is to be 535 feet. This company during the year ending October 31st has made a profit of £15,833, which allows a dividend of 7½ per cent. on the ordinary shares for the year ; 5 per cent on preference shares, £1022, the ship canal's royalty, and carrying forward £1,414. When the Ship Canal was opened, there were at-Manchester one graving dock, 450 feet long, and one pontoon dock, 260 feet long, capable of lifting 2,000 tons ; and at Ellesmere Port there was another pontoon dock, 350 feet long, capable of lifting 2,500 tons.

The exports of textile machinery from Great Britain are still on the increase. For November, the value was £611,421, as against £546,884 for November, 1905, and £427,394 for November, 1904. Since January the grand total to the end of November was £6,079,301, as against £5,042,404 for the corresponding eleven months of last year. The increase is over £1,000,000 sterling.

The imports of timber to Manchester have been latterly on a heavy scale, and both here and at Liverpool the consumption has been satisfactory. Stocks are of moderate dimensions. Manchester has received the bulk of the imports of Waney pine and spruce and pine deals from Nova Scotia and New Brunswick. The net increase in the aggregate Manchester imports for the first eleven months of the year was 878,000 cubic feet and 240,000 standards. The increase in the Manchester stocks of sawn pitch pine, Quebec board pine, and birch planks is noteworthy. In the first case there has been both an increased importation and a decreased consumption, whilst the increase in the consumption of birch planks has been less than the increase in importation.

The results of the recent coaling experiments on H.M.S. *Vengeance* and *Cornwallis* in the Mersey are believed to be better than anything yet obtained at Portsmouth or Devonport with the various transporters, chiefly by the gantry type used there. These results are of considerable interest to owners of large vessels navigating the Manchester Ship Canal. When the deepening of the Canal to 28 feet, now in progress, is completed, some anxiety will continue to be felt as to the safety of navigation by the largest class of steamers when loading at Manchester docks for direct sailing to Australia and the Far East. Vessels draw more water in the upper reaches of the Canal than at Eastham or in the Mersey estuary, and if it were possible to coal rapidly at or near the entrance of the Canal, these large steamers could be loaded in the Manchester docks. Coaling from patent barges like those used in the Admiralty experiments might solve the problem.

The patent coaling barges used at Liverpool are believed to be of American invention, but built and engined by a firm at Birkenhead. An ordinary elevator chain passes along the bottom of the barge carrying buckets, into which the coal falls through sliding hatches from the hold. The coal is then carried up by the chain to the top of a steel structure on the barge, and shot down into the ship's bunkers through long tubes which project through ports cut in the ship's side. The coal is said to be gently handled, and arrives in the bunkers in good condition.

A new vessel, the *Thoughtful*, with a carrying capacity of 1,100 tons has been placed on the Ship Canal to take part in the trade between Manchester and South Wales ports. The owners are Messrs. F. H. Powell & Co.

The railway rate from Manchester to London for woollen and cotton goods for export is only 25s. per ton. The rate from Bradford to London for the same class of goods is 32s. 6d. per ton. This is owing to Manchester being a port.

Mr. E. H. Johnson, of London, lately read a paper before the Manchester Association of Engineers on the "Third function of electric motor traction," which is, that electric energy may be regenerated from a moving car or train and delivered to the trolley, the third rail or the other supply conductors, then to pass on and assist the prime supply in creating mechanical power elsewhere.

Towards the close of the last month, a number of painters were painting a large iron railway bridge which spans the Manchester Ship Canal near Warrington, when a rope which suspended five of the men in a cradle underneath the viaduct broke. Two of the men made a grab at the bridge and hung on, but the other three were precipitated into the Canal, 70 feet below. Two of them, George Pickford and Walter Reid, were drowned.

There are now four sailings per week of vessels laden with cattle from Dublin to Manchester. These vessels, as a rule, carry 400 head, which are discharged at the coastwise pens at Mode Wheel. Nearly 1,000 head of American and Canadian

cattle have been landed at Manchester within the last fortnight.

The steamer, *Superb*, belonging to the Northwich Carrying Co., laden with Christmas goods, was run down in the Mersey Channel by a Liverpool Dock Board Hopper on the 14th December. The captain (Thos. Pickup) and mate (John Mills) were never seen again.

During the month the coal trade has continued brisk and prices steady, with a hardening tendency. Slack is very scarce, and the best qualities about 6d. per ton dearer. Coal on shipping account has been of a satisfactory character.

The iron market has been rising continually since the beginning of November, until, at the moment of writing, prices of pig iron and hematites have only been equalled twice within the last 26 years. Makers' prices for most brands have been withdrawn. Manufactured iron and steel are dearer. Engineering, textile machinists and electricians are in full employment. The outlook is still satisfactory.

THAMES.

(From our Own Correspondent.)

AFTER the announcement that the President of the Board of Trade would wait 12 months before deciding on the Port of London problem, as might be expected, other bodies interested will not wait that period before taking further steps. The London and India Dock Co. has already deposited a private Bill to enable it to carry out certain works, and the company now proposes to invite the trading authorities of the port, including shipowners, wharfingers and lightermen, together with the leading commercial organizations, and to confer together with a view of obtaining approbation to their measure. The Bill binds the Dock Co., among other things, to carry out the Albert Dock extension, and in this and other ways place itself under the control of the Board of Trade. The limitation of the company's dividends is put forward for affirmation, and it is laid down that any new income must be obtained from dues on goods as distinguished from ships. The matter is based on the idea that the company should be allowed to bring itself into line pending any action on the part of the Government, and the support of the mercantile community is asked for in the matter. Meanwhile early in the New Year the members of the London Chamber of Commerce will again meet to discuss this question and endeavour to come to some decision upon it which was adjourned on a previous occasion after views formulated against purchase by a new authority.

An application has been made to the Thames Conservancy by the London County Council as regards the embankment on the south side of the river near Westminster Bridge for the purpose of a site for the proposed new County Hall, and subject to the Council conforming to the suggestions of the Conservancy Engineer as to a modified line of frontage, the necessary licence has been granted. As conditions have been drawn up under which architects will compete for designs for the building to be erected, it may be assumed that steps will soon be taken to put the whole matter into execution.

The firm of Sir W. Arrol & Co., of Glasgow, is stated to have received the contract for the widening of Blackfriars' Bridge at a figure which amounts to over £200,000. The project will take over 3 years in the executing.

Even at this time of year Thames steamboats are thrust upon our notice by the announcement of the deficiency under this heading, for the year ending March 31 next, on the municipal service of £37,416. Even in the summer neither boats nor piers pay their way, and the debt charges account for £21,392 of the above amount, as tending to show that public bodies cannot borrow with impunity without incurring ever-increasing responsibilities. The Rivers Committee now confirms a proposal to transfer the boats to the Highways Committee and merge the service in that of the tramways, thus, we presume, covering up the loss. The reading of the report regarding such proposed transfer and the hopes for increased trade suggest little acquaintance with the river and its possibilities and no regard for the taxpayer, who finds the money to make up these continual losses caused by the mismanagement of persons financially irresponsible.

H.M.S. *Gnat*, the third of five coastal destroyers ordered from Messrs. Thorneycroft & Co., was launched with all machinery aboard from the Chiswick works of the company. The dimensions of the class to which this vessel belongs are—Length, 168 ft.; beam, 17 ft. 6 ins., and draught 5 ft. 11 ins., the compact speed being 26 knots. The *Gnat* is fitted with Parsons' turbine machinery and Thorneycroft water-tube boilers.

A scheme is mooted for opening up a line of steamers between the Danish port of Esbjerg and London to facilitate the import of Danish produce. The Danish authorities have taken to making an inspection of all perishable produce before being sent out of the country, and the London and India Docks are proposing to set aside a portion of the London Dock for the business and to erect at a cost of £15,000 a special warehouse constructed on thoroughly hygienic principles for the reception of such goods not taken into immediate consumption. A large quantity of Danish bacon, butter and eggs is received here already, and it is believed by the extension that a further increase will result. 100,000 tons of produce from the port named is the quantity dealt with annually, and under the scheme it is looked to reduce the price here, but that the direct service will tend to maintain the value of the goods.

The piece of plate presented by the City of London to H.M. ship bearing the name of the capital of the Empire, and which vessel is serving in the Mediterranean Fleet, has duly reached Malta and been received aboard H.M.S. *London* with great honour and ceremony. The model selected by the officers was the White Tower of the Tower of London, and it has taken a year to execute this important piece of work, which is to scale and manufactured by the Goldsmiths' and Silversmiths' Co., Regent Street. The model, previous to shipment, was inspected by the King and the Lords of the Admiralty.

Under the Pilotage Order Confirmation Act, 1896, a meeting to elect pilots to serve on the Pilotage Committee of Trinity House was held recently at the Guildhall. Three gentlemen are nominated for one place, so that at the meetings one is always certain to be ashore to sit. As the Trinity House deals with pilotage questions the practical experience of a pilot was considered by the Legislature to be necessary. The three gentlemen elected were Mr. W. C. Harrison, Mr. A. L. Sandford and Mr. T. H. Lygs.

The Arsenal labour question has now reached the point that the Government are to be asked to introduce the manufacture at this establishment of implements of peace instead of those of warfare to make up for the shortage of work and the discharge of men occasioned thereby. This will be seen to be a new departure in economics. The particular manufacture proposed is that of motors wherever required in the national service.

A new project at Dover for the widening of the Admiralty Pier and the building upon it of a new marine station at an estimated cost of a million sterling, the bill authorising which recently passed Parliament, has had the financial support of our French neighbours, by whom the whole of the capital is said to be subscribed by the way of a loan at 3½ per cent. interest. A bill has been deposited in Parliament incorporating the Channel Tunnel, the total cost of which is estimated at £16,000,000, half of which will be subscribed in this country, the remainder being promised in France as soon as the scheme has received sanction here.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow.—There are at last better prospects for the shipbuilding trade at Barrow. It has been very quiet for some time past, and the yard at the moment is almost depleted of work, the only vessels on the stocks being submarines for the British Government, which only occupy one part of

the yard, and the Brazilian battleship which has been started, but the work on which has been stopped owing to alterations in design, which it is understood will result in the vessel being much larger and much more powerful. At the moment there are few shipbuilding yards in the country more capable of taking orders than that at Barrow, nor one where new shipping tonnage could be more economically built, because Vickers, Sons & Maxim have laid themselves out in fulness of equipment and in the general economy of their yard to facilitate the building of ships on the cheapest lines, and yet they have not attempted to equip themselves to build what is known as cheap tonnage. Everything in the way of ship production at Barrow has been conceived on lines of the highest class of turn out, and therefore many possible orders for new ships have gone past local builders. But at the moment there are prospects of some good orders, outside of any possible Admiralty work from the home or foreign governments, and it is needless to say these will be welcomed in Barrow, as the shipbuilding department is the only branch of the local yard which is quiet. All other departments are as briskly employed as they can possibly be, and the outlook in shipbuilding bids fair to make that branch as active as the rest. It would be indiscreet to say much further, seeing that the new business spoken of is to a great extent in process of negotiation, but sufficient is known to give the assurance that new work of importance is within easy reach.

Vickers, Sons & Maxim have tendered, along with seven other firms, for the building of H.M. battleship *Superb* of the *Dreadnought* class, and from what is known at the moment they may stand a chance of getting the order, as it is known that the four firms on the Clyde are out of it in price. This leaves four firms still on the tapis—Vickers, Sons & Maxim, Sir Wm. Armstrong, Palmers and Camell Laird & Co. There has evidently been some keen cutting, as it is known that the vessel can be built for something less than £670,000, or £100,000 less than the *Dreadnought* cost. This proves the advantage of the construction of warships by private firms as compared with the cost entailed in dock yards. It is understood that all the firms who tendered for this ship have been cutting prices very keenly. At the moment it looks as though the order might go either to Birkenhead or come to Barrow. That is a question which probably will be solved during the next few days.

The *Coronel Vorognesi*, the second of the Peruvian cruisers, built at Barrow, is now ready for her deep sea trials. She has been undergoing dock trials of late under highly satisfactory circumstances and with really successful results. The anticipation is that she will exceed on her speed trials her sister ship the *Almirante Grau*, as experience was obtained on her trials which will lead to improvements on the second vessel. These cruisers, or scouts, or "eyes of the fleet," are an improvement on the British *Sentinel* and *Skirmisher* built at Barrow. It is probable they will be the forerunners of other new ships for the Peruvian fleet, as while these vessels may be sufficiently powerful and damaging to shipping and to certain types of war vessels, they cannot, of course, stand up against a modern man-of-war. Other South American Powers on the east coast are either building or are intending to build new war vessels of various types, and it is felt that Peru will have to protect herself against these ships. Indeed, Brazil has already ordered three battleships and other war vessels in this country, and it is known that the Argentina and Chili are also in the market.

There is a very brisk trade in the building of submarines, and although the Admiralty have not given out all their orders for this class of ship with Vickers, Sons & Maxim this year, the latter firm are very busy with the work they have in hand, and expect to remain busy in this special department for some considerable time to come, as submarines are looked upon as only in their infancy at present.

Vickers, Sons & Maxim and the Furness Railway Company have jointly agreed to widen the passage way between the Ramsden and Buccleuch Docks at Barrow from 80 to 100 ft., at a cost of £70,000, which will be jointly paid by the two companies at £35,000 each. If the amount exceeds £70,000 the railway company are not called upon to pay more than £35,000. This engineering work has been rendered necessary in order to enable Vickers, Sons & Maxim to build the largest warships or merchantmen. The work, which has been entrusted with Sir John Aird & Co., is to be completed by the end of October next year.

A difficulty arose some time ago as to the dolphins to be constructed on each side of the new Walney Bridge. The scheme of the Corporation of Barrow designed by Sir Benjamin Baker, was that dolphins should be constructed 50 ft. in length on both sides of the opening bascules, but the Furness Railway Company, as the Harbour Commissioners, asked that these should be extended to 400 ft. on the south side and 200 ft. on the north side, a difference in cost of about £30,000 to be added to a cost of £150,000 for the bridge as originally designed. A Board of Trade arbitrator case was held at Westminster, extending over six days, before Sir William Matthews, the arbitrator, and his award is being anxiously awaited.

West Cumberland.—A steady trade is being done at the small shipbuilding yards at Workington and Maryport, and it is probable the present activity will be maintained for some time to come.

Shipbuilding Material—There is a moderate, but not brisk, demand for shipbuilding material, and the mills are not regularly employed. Prices of plates have advanced to £7 15s. per ton net cash.

Hematites.—The demand for hematite iron is very brisk, and prices have advanced to 80s. 6d. per ton net cash, with every prospect of going higher. Stocks are firm and steady at 72,955 tons.

Shipping.—The shipping trade is steady with exports of iron and steel for the year up to date at 789,153 tons, a decrease of 4,146 tons on the corresponding period of last year.

BELFAST.

(*From our Own Correspondent.*)

AS may be seen from the returns, Belfast shipbuilders have no reason to be ashamed of their contribution to the output of new tonnage for the year 1906. Trade is fairly brisk at present, and it is to be hoped that this condition of affairs will continue. As regards the amount of repair work executed during the past twelve months, this has not been very great, owing, of course, to the want of graving dock accommodation through the disastrous subsidences at the Alexandra Dock. The sooner the extensive repairs to this dock are completed the better for the port.

Messrs. Harland & Wolff are said to have received an order for a new White Star liner 650 feet in length. In last month's notes brief reference was made to the reported sale of the new Leyland liners *Servian* and *Scotian*. It has since transpired that they have passed into the hands of the Hamburg-American Company. These vessels it may be remembered, were launched in 1903, and were, until recently, laid up in the Musgrave Channel. The fitting out of the first-named vessel was well advanced, but extensive alterations are to be carried out to the requirements of the new owners, who, it is said, will employ the steamers as transports for carrying troops and munitions of war to the German colonies in South-West Africa. These two ships, which have each a gross tonnage of close on 17,000 tons, will be renamed *Berlin* and *Chicago* respectively. The new Elder Dempster liner *Aburi*, built at the Queen's Island, will shortly be ready for sea. Her trial trip will be followed a week or two later by that of the sister ship *Sierra Leone*. The Telegraph Construction and Maintenance Company's twin-screw steamer *Anglia* has changed hands, and on the passage to Belfast, where she is to undergo alterations at the hands of Messrs. Harland and Wolff, the vessel has gone ashore on the County Down coast. In addition to salvage boats, Messrs. Harland and Wolff's two powerful tugs are in attendance. The *Anglia* is a vessel of 6538 gross tonnage, and was built in Barrow in 1898. The Australian mail steamer *Orotava*, which has been undergoing overhaul and alterations at the Queen's Island, will be ready for sea before these notes are published. Henceforth she will sail under the flag of the Orient Royal Mail Steampacket Amalgamation. Another of the company's steamers is expected at the beginning of the year

for overhaul and repairs. Amongst other lines for whom Messrs. Harland & Wolff are at present building may be mentioned the White Star, Hamburg-American, Elder Dempster, and Anglo-American Oil Company. As well as the oil-tank steamer which they have in hand for the last-named, they are also constructing for the same firm a barge of large capacity for carrying oil in bulk.

On the 15th of December Messrs. Workman, Clark & Co. launched from their South Yard a steamer named *Salaga*, built by them to the order of Messrs. Elder, Dempster & Co., The new steamer is 395 feet long, with a gross tonnage of about 4000. The main engines are triple-expansion, steam being supplied by three single-ended boilers. Before the close of the year Messrs. Workman, Clark & Co. will put in the water from their North Yard a sister ship for the same firm.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

AS we have on previous occasions remarked, lamps of various types are being continually improved upon, and tests of the different kinds are, therefore, worthy of note. Recently experiments have been made to determine the values of some of the filament forms, and we quote from the results to hand tending to show that for an ordinary carbon lamp a rise in pressure of 1 per cent. gives in candle power an increase of from 6 to 7 per cent., while with an osmium lamp this figure is 4½ per cent, and with a tantalum it is 4⅓ per cent. change in candle power. These figures for voltage are further supplemented by others to show that in carbon lamps the candle power varies as the cube of the volts, while with tantalum it varies as the 2½ power of the watts. This is with continuous current.

Claims are made that the mercury vapour arc lamp has several advantages over the carbon arc, one of which is that its rays will pierce fog so much better. Anyway, the light being due to a vapour, it is to be readily understood that different results are likely to follow from those of the ordinary carbon lamp. In the usual type of this lamp mercury is contained inside a zigzag tube made of glass, and when current passes the magnet it tilts this tube up, the mercury flows back into a bulb and the arc strikes. The density of mercury vapour is greatly above that corresponding to maximum conductivity. So far only direct current has been successful with this system, but it is a good working one. The life of these lamps has been as much as 5000 hours, or even double, and they are said not to show any signs of ageing. The colour was somewhat difficult at first, but this is now said to be provided for, and it is made similar to sunlight, we are told. A peculiarity is that it gives out a great deal of heat. In some forms it scorches paper and is hotter than an ordinary glow lamp.

With the rapid strides being made with wireless telegraphy, we have now to chronicle a new development in the Poulsen system, demonstrated in London quite recently. The basis of these experiments is known as that of undamped waves in contradistinction to the ordinary spark telegraphy, which employs damped waves or those which lose in amplitude as they recede from the transmitting centre, and which, rapid as are the oscillations produced in the ether of space, are not continuous theoretically. Following up an idea developed by Mr. Duddell in England, some seven years ago, Mr. Poulsen has immersed his arc in hydrogen gas and obtained oscillations of a million or more per second from a previous thirty to forty thousand, and thus produced continuous or undamped waves. For these waves great advantages are claimed, foremost of which is the power to tune the messages so that they can be worked with others practically without interference. With a power of one kilowatt, perfect communication has been established between Copenhagen and North Shields, with a height of mast of only 100 ft., and the inventor predicts that with 10 kilowatts he could communicate across the Atlantic. The power of tuning is, of course, very important, and stations can, it is claimed, be worked without marked interference when the difference in wave lengths does not exceed 1 per cent. He says, as an example, stations may work together with a wave length of 600 metres, and two others in the same territory with a wave length of 606 metres, and yet the signals only be received where they are due. It is clear, therefore, from the above that these are very important results, and not at all of a laboratory kind.

The well-known firm of the British Insulated and Helsby Cables, Ltd., are prepared to supply electric welding machines to weld from the smallest wires up to ¾" in iron or steel, brass to $\frac{9}{16}$", diam. and copper to ⅜". Alternating current is employed connected to a primary coil of a transformer, the secondary coil consisting of a single convolution terminating in two massive clamps which grasp the two rods required to be welded. With a generator current of, say, 100 volts, at the primary coil, this is transformed by electro-magnetic induction to a current of low voltage, but great strength in the secondary coil, which flows across the two ends to be welded and which are brought together under moderate pressure. The resistance is all located at these two points, and the heat thus developed where it is wanted. A device is employed for regulating the pressure, and when the metal begins to flow the ends become perfectly united, and the current is automatically cut off at the right moment. It is said with current at 1d. per unit a thousand welds only cost 1s. 6d.

Messrs. Monté, Callow & Co., of Ipswich, are agents for an electric dynamometer which is used for testing the power of high-speed motors, and this machine consists essentially of a dynamo, the magnetic circuit of which is movable. The casting carrying the field magnets oscillates on ball bearings concentric with the bearings of the armature. The armature, working as a generator, tends to rotate this casting while the balance is maintained by a beam lever and weight. This arrangement allows correct readings to be taken of the power and speed, the efficiency of the dynamo not interfering with the determination of the power of the motor to be tested. The machine is thus an absorption apparatus, and differs from the Prony brake in that friction is replaced by an electro-magnetic reaction. Machines from 2 to 150 H.P. have been made and sold on this system.

Bull's Metal Propellers.—During the year now closed, the Bull's Metal and Melloid Company, Yoker-on-Clyde, have had a very extensive output both of large solid propellers and of separate blades and built-up propellers. One of the items of the year's output was a solid propeller cast in bronze, weighing as much as 9¾ tons, being what is believed to be the heaviest solid propeller of this kind ever made. It was for the 8,000 ton steamer, *Charkas*, built on the Tyne and fitted with quadruple expansion engines by the Wallsend Slipway and Engineering Company. The speed and consumption trials of this vessel have been extremely satisfactory. The pronounced advantages of adopting the solid Bull's Metal Propellers are being more and more recognised. There is not only a very large substantial increase to the speed through their adoption, and a consequent very material saving in the coal bill, but, as has been proved in many recent cases, their adoption means a considerable reduction in the strain on shafting through the reduction in weight (about 25 per cent.) and reduced racing of the propeller in a seaway. Fitted with cast-iron propellers, shaftings have been repeatedly broken within a comparatively short period, whereas fitted with Bull's Metal Propeller, the same steamer's shafting has remained unimpaired over greatly-extended periods, and with the same propellers fitted throughout. Thus, improvement in speed, saving in coal, the minimising of vibration, and the immunity from breakdown of either shafting or propellers, are all advantages, which are more and more commending themselves to shipowners and insurance societies alike. The most important work in the way of propellers consisted of eight propeller blades for the S.S. *Athenia* of the Donaldson Line. The Company have as usual been well requisitioned during the year for their special metals, and the varied items in engineering practice to which these metals so effectively lend themselves. An important extension to the Company's works has just been completed in the way of a rolling mill for bronze and brass, which is the first of its kind in Scotland. By means of this new adjunct to their business, the Company will be able to roll bars in these metals of from 5 ins. diameter downwards. Forged bars have already been delivered up to 9¾ ins. diameter.

JUNIOR ENGINEERS.

IV*.

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Pattern Making *(continued)*.

THE principle of the sweeping up process of propeller construction is that if a right triangle of a pliable material be placed with its base horizontal and circled round a vertical axis, the line of the hypotenuse will ascend from the base to the apex in spiral form. If now the axis be replaced by a cylinder corresponding to the propeller boss, and a horizontal guide, the generatrix, resting on the hypotenuse, the directrix, be swept up and round this cylinder, a path of screw form will be traced out, and the base of the triangle being made equal to the circumference of the circle to which it is formed, the vertical height will be the pitch of this screw.

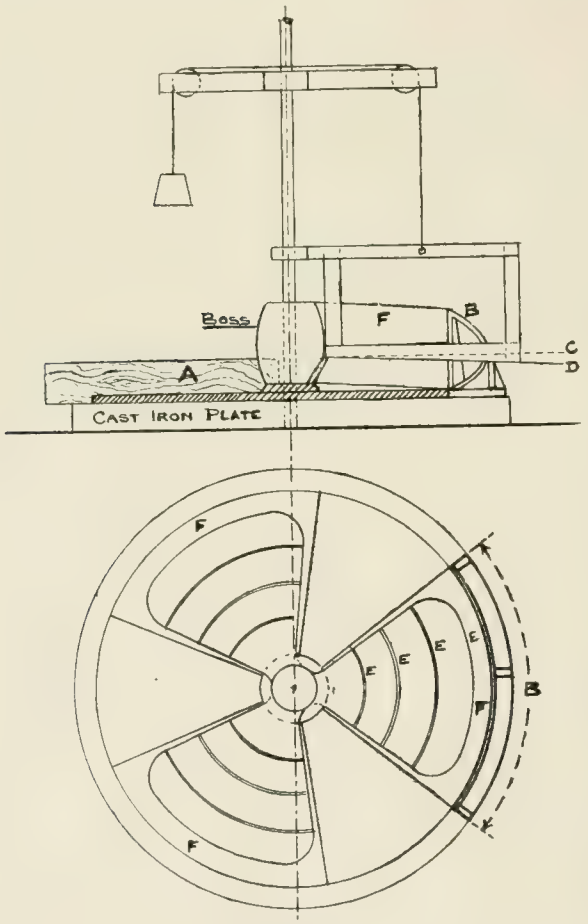


FIG. 1.

A portion of this single thread screw will form a one-bladed propeller, two, three or more blades being obtained for double, triple or multiple threads by spacing equally round the circumference the corresponding number of triangles.

Referring now to Fig. 1, a cast iron plate about 3" thick supports a vertical spindle and guide, this guide being free to move in a vertical and circular path and counterpoised by a steadying weight with chain and pulley blocks.

* For Articles I. to III., see last three issues.

A bed of loam is levelled up on the plate by means of board A, which traces out a circle 6" larger in diameter than the propeller required, this board also forms the truncated cone piece upon which the boss rests, the height of this depending upon the amount of projection of the blades below the boss. Where the boss is of the simple form shown, it is swept up in loam, but for those of complicated construction, especially with the larger propellers with separate blades, a wooden pattern is made, and the guide spindle passed through it.

With the driving face of the screw at right angles to the vertical axis the generatrix will be as shown at C. Fig. 1, but if the blade be "set" at a greater or less angle the sweep will be as at D., Fig. 1, in which latter the blade will be set aft at the tip relatively to the root, or it may be a curved set to which the sweep will require to be formed.

The directrix B., Fig. 2, is formed by cutting out a wooden base to the same curvature, on its concave side, as the bed loam against which it is butted; upon this base of about 6" broad, uprights are fixed, and to this framework the directrix triangle of $\frac{1}{4}$" template wood or thin sheet iron, is attached; the expanded dimensions of the triangle are obtained from the particulars on the drawing, and this thin structure having been fixed upon the framework by bending to suit, the whole is attached to the foundation plate, as at B, Fig. 1.

With a screw of regular pitch, this directrix in its expanded form will be a right triangle, but with an expanding pitch axially the guiding line will be curved to suit the rate of expansion, the ordinates for this curvature being obtained from the drawing.

Having now placed B in position and adjusted the sweep D, a rough brickwork setting is built up to form the pier; then upon this the loam is spread, and the sweep revolved round the spindle to shape this solid to the same level as

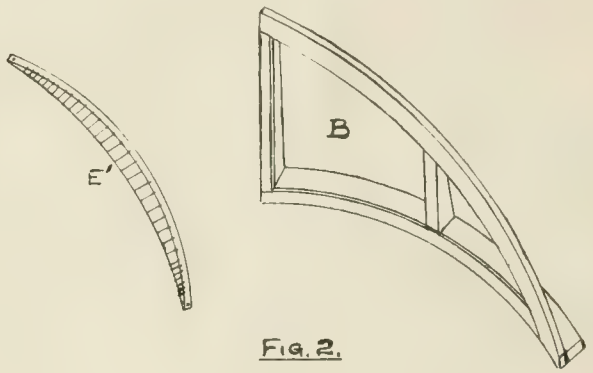


FIG. 2.

the directrix; to ensure the sweep maintaining the correct position, a spiral strip is sprigged to the boss as a guide at this end. This pier is then left to dry, while the process is repeated for the others by moving the guide B round the circle to the other positions.

These surfaces, which form the under side of the mould and the driving faces of the blades, are blackwashed and the outline of the blade is drawn in upon the dried surface to the contour given in the expanded view, the lines E, E, having been scribed upon the mould by notches cut in the sweep; these lines are from 12" to 18" apart, and are the positions of the thickness sections shown on the drawing: to these lines the thickness pieces, shown pictorially at E', Fig. 2, are sprigged and the spaces between them filled in with loam or green sand to the blade outline, the whole being smoothed over to the correct thickness, thus forming the pattern of the blade. The thickness pieces are cut to the sections in the expanded blade, and bent to the required curvature by saw drafting.

This surface in its turn having been dried and blackwashed, the cope of bricks, iron bars or plates, is erected over the mould and filled in with loam to take the impression of this pattern; the upper mould thus taken is dried, removed from its place, blackwashed and again dried thoroughly. In the meantime the process is repeated for the other piers.

The boss is then removed, the core for the shaft hole placed in position, and the copes replaced; the mould is thus assembled and ready for ramming to prepare for casting.

This method of propeller construction is the most usual for all styles, those in which the blades are separate from the boss are swept up in similar fashion, a wooden pattern being made for the boss and the flanges.

The practice of making a solid wooden pattern by building up the blade in strips is expensive, but gives a more reliable casting, especially with screws of expanding pitch, and with several castings required from the same pattern the difference in cost is reduced. With standard types of propellers the cast pattern is also employed, the weight of the pattern being reduced by coring the blade honeycomb fashion.

Screw propellers, their design and construction, are well worth the close study of the apprentice, for with the advent of the turbine the subject has become of paramount importance in marine practice. On the solution of the question rests, to a large extent, the wider adoption of the new method of propulsion.

In leaving this section of shop practice there is little need to remark upon the influence which the construction and cost of patterns has on the design, and a knowledge of the methods of production is invaluable in this connection.

REVIEW.

Traite de Physique.—By O. D. Chwolson. In two vols. Paris: A. Hermann. 1906.

IN the first volume we have the density and tension of gases, leading to barometers, and the laws in relation to gases generally. The subject is treated by the author—as in volumes of his we have previously noted—with the utmost attention to detail. This is a standard work. It has already been translated from the original Russian into German and French, and it is this last we now have before us. The methods of finding the density of gases, for instance, are fully discussed, and the experiments shown in every case. We have the advantage here that the ablest minds of every country are noticed. The chapter on barometers and experiments connected therewith shows how much fuller this branch is than one would imagine from examples with which we are familiar in everyday life. We have all the movements of gases treated and the laws that govern them given in great detail, such as the change of volumes on the application of pressure, escape of gases from orifices, diffusion of two different gases, simple and over-metallic bodies. The question of resistance of gases to the movements of solid bodies follows, and with the motion of air we have a description of anemometers. The theory of navigable balloons is discussed closely in every way, as to stability and limits of speed.

Refraction and prisms are studied very fully, and the apparatus employed in determining the laws governing the same. The influence that different substances have on the index of refraction, also the changes of temperature are noted, and the values given for different substances, liquids, and gases. The question of the spectrum is next treated, and this is a branch which admits of much completeness. We do not find, as in older works on physics, merely the colours of the solar spectrum, but, as throughout these two volumes, a thorough collection of all the experiments that have been published, irrespective of country from whence proceeding. All really scientific men will greatly appreciate what is found here. Spectrums are seen to be of many different forms, besides the ordinary ones with which we are mostly familiar, of bands. The methods of representing them graphically are found, too. We have thus full particulars of different substances. With the solar spectrum the question of spots on the sun is discussed, and the effect on the spectrum rays. Those of the moon and planets follow, and, what is more interesting still, what comets have to teach us by these means. It is shown how the principles of spectrum analysis have been applied to study the movement of the stars, as motion affects the rays of the spectrum, and thus their speed is determined.

Colours are another branch taken up, and by the aid of the spectrum we find how these are produced, and what their numerical values are. In connection with spectrum analysis, a note is added of how to use the system, and this, apparently, is not a translation from the author's work, but introduced as supplementary. With nearly a volume bearing on the subject, this addition would seem to have been unnecessary, and could have been dispensed with. The action of light is discussed, both mechanically and chemically. Certain substances can take, for instance, the colour of neighbouring bodies, and arguments follow to show the different colours certain plants have and why they have them. Photography finds a place here in a short note at the end, and throughout with each chapter reference is made to the sources of supply of the information given. The labour entailed is immense. Whether any parts are to come is not mentioned, but it would seem that any further additions may only be limited by the opportunities at the author's disposal. We should certainly say that no work on physics exists that can compare with the amount of information found here. We have only been able to name a few points on each branch taken up, but the author has every authority at his disposal, and uses the materials thus given him to weld into a continuous publication the very latest experiments that have been conducted, with complete comments and laws relating thereto. Though not abstruse in any way, a reader must possess considerable mathematical knowledge to be able to assimilate the many points touched upon. Teachers would find such volumes of the greatest value, we should say.

The Sturrock Patent Furnace Bridge.—The Sturrock Patent Bridge and Engineering Co., of Dundee, report a very satisfactory year's turnover in the way of their patent metallic furnace bridge, both for marine and land purposes. Over 150 steamers have been fitted with this type of furnace bridge, which is more and more coming into favour and receiving very widespread adoption. Steamers have been fitted in the United States, Canada, France, Germany, Austria and in Norway. Besides the marine work overtaken a considerable number of land installations have been carried out. The firm are well booked for 1907. It is often said that Britishers are slow to adopt new inventions, and while no doubt there is considerable truth in the assertion, the Sturrock Co. have not found it so in the case of their speciality. It is, of course, a thoroughly practical and highly economic adjunct to boiler installations both on board ship and on land, and it appeals to the solid ideas of British engineers. To this circumstance the company attribute the fact of the steady and increasing demand for their speciality.

Character was the subject of a most admirable address delivered by Mr. T. F. Aukland to the Institute of Marine Engineers on Monday, Nov. 26th. The address consisted of extracts culled from the writings and speeches of the best and most notable men of all times. These were put together and commented upon by the lecturer in a most pleasing manner, which held his audience—chiefly junior engineers and lady friends—entranced. The after results will doubtless remain with those who were privileged to hear Mr. Aukland instilling noble thoughts and giving inspiration towards a study of the best of all ages.

Battle's Patent Nautical Indicator. London: Simpkin, Marshall & Co., 1906.—This indicator is in the form of a fold-up cardboard case, and is for indicating the rule of the road at sea for steam and sailing ships. The question has always been a vexed one at sea, and if this helps to solve the difficulty in any way considerable merit will attach to the inventor. The arrangement for steamers consists of directions where, by turning a dial, for three different cases we have the red and green light appearing through the required hole in the dial plate, and also the instructions at the indicator of "keep out," "stand on" or "alter course to starboard." For sailing vessels the system is a little more complicated, but there is the same turning the dial with the directions according to the direction of the wind. The reasons for the indications for sailing ships are given on a third panel. Probably the dials might be turned in an easier manner than they are in the arrangement, but whether in anything of this kind a seaman would have the opportunity of consulting a dial of this character we are unable to say. It is doubtful, we think, but practical tests alone will prove the truth of the matter.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Arawa.—On November 29th there was launched from the Wallsend Shipbuilding Yard of Swan, Hunter & Wigham Richardson, Ltd., a steel twin-screw passenger and cargo steamer, which is being built to the order of the Shaw, Savill and Albion Co., Ltd., and which is named the *Arawa*. Her dimensions are 460 ft. B.P. × 60 ft. beam × 42 ft. 6 ins. depth to shelter deck. The vessel has been specially designed for the owners' service between London and New Zealand, and is fitted up to carry a very large cargo of frozen mutton, the holds being insulated for this purpose with suitable refrigerating machinery by J. & E. Hall, Ltd. The vessel has also accommodation for about 40 first-class passengers, 60 second-class and about 120 third-class. The accommodation for the first-class is being provided in two rows of houses above the shelter deck, both first and second being provided with dining saloon, smoking room and ladies' room, the third class being aft under the shelter deck. The machinery has been built by the Wallsend Slipway and Engineering Co., Ltd., and consists of two sets of triple expansion engines driving twin screws; together with 4 large boilers working at a pressure of 205 lbs. Wailes, Dove & Co.'s bitumastic covering was applied to the tank tops in boiler room, tunnel and refrigerating rooms. During construction the vessel and her machinery are under the supervision of Capt. McKirdy, the owners' marine superintendent, and Capt. Scotland; also Mr. Adams, their superintendent engineer.

Goathland.—On December 3rd there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, a steel screw steamer built to the order of Christopher Marwood, Esq., of Whitby, and of the following dimensions, *viz.*: Length, 341 ft., breadth, 48 ft.; depth moulded, 24 ft. 4½ in, and to class 100 A1 at Lloyd's, on the single decked rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including six double cylindered steam winches, direct acting steam windlass, large donkey boiler, steam steering gear by Messrs. J. Lynn & Co., Ltd., of Sunderland, and Hastie's sscrew gear aft. The engines, which are supplied by Messrs. J. Dickinson & Sons, Ltd., of Sunderland, are of the triple expansion type, having cylinders 24 in., 40 in., and 65 in. × 42 in. stroke, and working at a pressure of 180 lbs. On leaving the ways the vessel was named the *Goathland* by Mrs. Lewis George Rowland, of Whitby.

Billiter—On December 4th, for Messrs. John Sunley and Co., the well-known London shipowning firm, Messrs. Wm. Doxford & Sons, Ltd., launched from their yard at Pallion the turret steamer *Billiter*. The vessel is constructed on the new clear hold principle, by which the holds are entirely freed from stanchions, cross beams or any other kind of obstruction, with obvious advantage to the stowage of cargo. The *Billiter* is the first of several duplicates in hand at Messrs. Doxford's for the same firm; the principal dimensions of the vessel are:—Length, 366 ft.; breadth, 50 ft. moulded; depth, 26¾ ft.; 6600 tons of dead weight will be carried on a draft of 21 ft. 9 in. Engines, with cylinders 24 in., 41 in., 68 in. × 45 in. stroke and two boilers 16 ft. 6 in. × 11 ft. 3 in., are being supplied to give a speed of 10 knots. The christening ceremony was entrusted to Mrs. Fred Hall, London, who commendably performed the duty, naming the vessel *Billiter*.

Vera.—On December 12th Messrs. Wood, Skinner & Co., Ltd., successfully launched from their shipbuilding yard at Bill Quay, Newcastle-on-Tyne, a finely modelled steel screw steamer which has been built by them to the order of Martin Carl, Esq., of Copenhagen. The vessel is of the single-deck type with poop, long bridge and topgallant forecastle. Water ballast is arranged all fore and aft on the cellular system and in the fore and after peak tanks, to enable her to be put in good trim for light passages. The saloon, captain's accommodation, etc., is arranged in the poop aft, the officers and engineers being berthed in side-houses under the bridge and the crew in the topgallant forecastle. The vessel will be fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo and general working and navigation. The machinery, which is of the improved triple expansion type, has been constructed and will be fitted by Messrs. The North-Eastern Marine Engineering Company, Ltd., at the Northumberland Engine Works, Wallsend-on-Tyne. Both the ship and engines have been constructed to the requirements and under the special survey of Lloyd's for their highest classification, and are also being superintended by Captain Lagesen, on behalf of the owner. The christening ceremony was gracefully performed by Miss Skinner, of Westoe, South Shields, who named the vessel *Vera*.

Clearpool.—On December 14th Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length, 370 ft.; breadth, 51 ft.; depth, 28 ft. 5 in. The vessel is classed 100 A1 at Lloyd's, and has been built to the order of The Pool Shipping Co., of West Hartlepool (R. Ropner & Co., managers), and is fitted with the builder's patent improved trunk deck. The saloon house, with accommodation for captain and officers, and a house for engineers, will be fitted up on trunk deck, with the crew in the T.G. forecastle. The vessel has double bottom for water ballast on the cellular principle, also in the fore and after peak tanks. The deadweight carrying capacity will be about 7,000 tons on Lloyd's summer freeboard. The vessel will be fully equipped with an up-to-date outfit, having a quick warping windlass, stockless anchors, steam steering gear amidships, with powerful screw gear aft. The appliances for loading and discharging expeditiously are very complete, and include extra derrick posts and double derricks, nine steam winches, steam being supplied by a horizontal multitubular donkey boiler. The engines will be of the triple expansion type supplied by Messrs. Blair & Co., Ltd., of about 2,100 I.H.P., steam being supplied by two extra large main boilers at a working pressure of 180 lbs. per square inch. The christening ceremony was gracefully performed by Master John Raymond Ropner, "Ambleside," West Hartlepool, who gave the vessel the name of *Clearpool*.

Manica.—On December 14th Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough, a fine steel screw passenger and cargo steamer built to the order of Messrs. Empriza Nacional de Navegacao, of Lisbon. She is built to Lloyd's 100 A1 class awning deck rule, her principal dimensions being 233 ft. 8 in. × 33 ft. 2in. × 17 ft. moulded, with a deadweight carrying capacity of over 800 tons on a light draught of water. The accommodation and saloon for first-class passengers will be provided in awning 'tween decks with entrance house and smoke room above. Captain and officers' cabins will be fitted up in steel house on top of smoke room, and engineers, etc., in steel deck house in front of smoke room, the sailors and firemen being berthed in forecastle. The awning deck will be of teak and main deck pitch pine. Triple expansion engines placed aft will be fitted by the North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 15½ in., 25 in. and 41 in. × 27 in. stroke, supplied with steam by one large boiler working at 180 lbs. pressure. On leaving the ways she was named *Manica*. The vessel and her engines are being built under the superintendence of Mr. T. C. Law, the owner's representative.

Rauenfels.—On December 14th the *Rauenfels*, which is being constructed by Swan, Hunter & Wigham Richardson Ltd., to the order of the Deutsche Dampfschifffahrts Gesellschaft "Hansa" of Bremen, was launched from the Neptune Works, Newcastle-on-Tyne. The vessel is a finely modelled steel screw steamer 436 ft. long by 55 ft. 3 inches breadth, and is expected to carry about 8,500 tons deadweight on a light draught of water. The propelling machinery consists of a set of four-crank quadruple expansion engines on the Yarrow, Schlick & Tweedy system, together with three large single-ended boilers. These are also being constructed at the Neptune Works. The auxiliary machinery is of the most modern and complete description, and includes 9 steam winches, steam windlass, steam steering gear, electric light, etc., etc. The christening ceremony was witnessed by a goodly number of spectators, and was gracefully performed by Mrs. H. V. Dickinson, of Aydon Grange, Corbridge.

Irmingard.—On December 15th an important launch took place from the yard of the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, the vessel being a finely-moulded steamer built to the order of Messrs. The Midgard Deutsche Seeverkehr's Aktiengesellschaft of Bremen, it being the first steamer built by the Northumberland Shipbuilding Co. for this company. The vessel is 372 ft. overall by 48 ft. beam extreme by 30 ft. 10 in. D.M., and has been built under special survey to the highest class at Lloyd's Spar Deck Rule with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation, which is very ample, being all placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops or emigrants may be carried if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes has been arranged for, consisting of 9 steam winches by Messrs. Clark, Chapman and Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, steam steering gear by Messrs. Hastie & Co., Greennock, and steam windlass by Messrs. Emerson, Walker and Thompson Bros. She is, of course, fitted with the usual water ballast arrangements for light passages. The vessel is designed to carry 7,300 tons d.w. on a draught of 25 ft. ½ in., and steam about 10 knots loaded at sea. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, the engines having cylinders 25 in., 41 in. and 69 in. by 48 in. stroke. Three large steel boilers 14 ft. by 10 ft 9 in., 180 lbs. working pressure.

Steel Screw Steamer.—On December 15th the Blyth Shipbuilding Co., Ltd., launched from their shipbuilding and graving dock works, a large steel screw steamer measuring 343 ft. × 47 ft. 3 in. × 24 ft. 5 in. moulded. This vessel has been built to Lloyd's highest class (special survey). She is of the single deck type built to the three-deck rule, and has poop, long bridge and forecastle. The saloon and captain's cabins and accommodation for officers and engineers are arranged in deck houses on bridge deck, whilst the crew are berthed in topgallant forecastle. The steamer will be specially adapted for the grain and timber trade, having 5 large cargo hatches with double derricks for expeditiously loading and discharging cargo. Deck machinery of the most improved type will be supplied, including 5 powerful steam winches and steam windlass by Messrs. Clark, Chapman and Co., Ltd., and Donkin's steam steering gear. Triple expansion engines of good power will be fitted by Messrs. North-Eastern Marine Engineering Co., Ltd., of Wallsend.

Trelawny.—On December 15th a new screw steamer named the *Trelawny*, built to the order of the Hain Steamship Co., Ltd., St. Ives, was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields. The vessel is of the improved single-deck type to Lloyd's highest class, and designed to carry 6,700 tons deadweight on a moderate draught, having a cellular double bottom all fore and aft, and fitted with poop, long bridge and topgallant forecastle. Steel houses for captain and officers, and also for engineers and apprentices, are constructed on the bridge deck, the crew being berthed in the forecastle. The vessel is also fitted up with grain feeders in accordance with the Grain Cargoes Act. The vessel will be fitted with triple expansion exgines, also constructed by Messrs. John Readhead & Sons, having cylinders 25 in., 42 in. and 68 in. by 45 in. stroke, supplied with steam from two large steel boilers working at a pressure of 180 lbs. per square inch. This is the 48th vessel built for the above firm by Messrs. John Readhead & Sons.

Westhampton.—On December 15th Messrs. Osbourne, Graham & Co. launched from their yard at Hylton the steel screw steamer *Westhampton*, which they have specially built for The British Maritime Trust. She is a single-deck steamer with poop, bridge and forecastle, designed to carry about 3,150 tons on a moderate draught, and takes Lloyd's highest class. Accommodation is fitted up in the poop, and officers and engineers are situated amidships. Her deck equipment comprises all the latest appliances for quick handling of cargo, large multitubular donkey boiler, steam steering gear, etc. Her machinery is by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland. The christening ceremony was performed by Miss Jessie Patterson, of Sunderland.

Chipana.—On December 17th Messrs. Short Brothers, Limited, launched from their shipbuilding yard at Pallion, Sunderland, a handsomely modelled steel screw steamer, built to the order of Messrs. Grace, Brothers & Co., Limited, of London. The dimensions of the vessel are :—Length, 434 ft. ; breadth, 54 ft. 4 in., and depth moulded 30 ft. 10 in., carrying a deadweight cargo of 9,300 tons on a moderate draught, and she has been built to the highest class in Lloyd's Rules, on the deep frame principle, with shelter, upper and main decks laid. To enable the vessel to carry large pieces of machinery and other bulky cargoes, special attention has been paid to the pillaring arrangements, heavy girders and wide-spaced built pillars being substituted for the close spaced pillars required by Lloyd's Rules ; ample water ballast is provided in the cellular double bottom and in fore and after peaks, the double bottom being also adapted for the carriage of oil fuel. Lofty and comfortable accommodation is fitted in saloon house for captain and passengers, the saloon being handsomely decorated in polished oak ; the officers and engineers have berths in deck houses fitted alongside casing on shelter deck, and the crew in the after end of shelter deck. To facilitate the loading and discharging of cargo the derricks are mounted on strong tables built on the masts, special derrick posts being provided to work the cross bunker hatch ; twenty derricks are fitted, capable of lifting weights up to ten tons, also a steel derrick for weights of 30 tons, and arranged to work at fore main and after main hatches. The vessel is fitted with sidelights throughout shelter deck, and a complete system of ventilation is arranged. The deck machinery is of a first-class description, comprising ten specially designed steam winches, steam and hand windlass, steam steering gear fitted at after end of engine-room worked by rods from pilot bridge, steam being supplied from a powerful multitubular donkey boiler, of 120 lbs. ; pressure fitted on upper deck, and exhausting to a winch condenser fitted in discharge recess. Clayton's patent fire extinguishing and disinfecting plant is fitted to each hold and to all accommodation. The vessel is fitted throughout with electric lighting on the double wire system. The propelling machinery has been built by the North-Eastern Marine Engineering Co., Ltd., Wallsend, and is of the Yarrow, Schlick, Tweedy Balanced Quadruple Expansion type, having cylinders 24½ in., 35 in., 51 in. and 74 in. diameter with a stroke of 51 inches. Steam is taken from three large boilers of the cylindrical multitubular type, adapted to work at a pressure of 220 lbs. per square inch, and fitted with Howden's system of forced draught. On leaving the ways the vessel was gracefully christened by Miss Grace, daughter of M. P. Grace, Esq., Battle Abbey, Battle, Sussex.

Washington.—On December 17th there was launched from the shipyard of Messrs. Cochrane & Sons, Shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 125 ft. by 22 ft. by 11 ft. 9 in. depth of hold. The vessel has been built to the order of Messrs. The Premier Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes & Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Washington* by Mrs. Blakelock, of Grimsby, wife of one of the directors of the company, after which the company adjourned and breakfast was served, and the customary toasts given and responded to.

Headley.—On December 17th Messrs. William Gray and Co., Ltd., launched at West Hartlepool the large steel screw steamer *Headley*, which they have built for Messrs. Houlder, Middleton & Co., London. The vessel will take the highest class in Lloyd's and is of the following dimensions :—*viz.*, Length overall, 375 ft 6 in. ; breadth, 50 ft., and depth 28 ft. 4½ in. She is a handsomely modelled vessel of the strengthened spar deck type, with two decks and poop, long bridge and forecastle. Very tasteful cabin accommodation is being fitted in houses on the bridge deck for passengers, captain and officers and the crew's berths in the poop, and electric light is fitted throughout. The vessel has a cellular double bottom and after peak tank for water ballast. The decks are of steel and iron, and the whole of the outfit including steam windlass, steam steering gear, ten steam winches

with return exhaust and marine type donkey boiler are of the most approved description. The machinery is made by the Central Marine Engine Works of the builders, being of the triple expansion type with cylinders 26 in., 43 in. and 72 in. dia., with a piston stroke of 45 in., and three large steel multitubular boilers working at a pressure of 180 lbs. per square inch. The vessel and machinery have been constructed under the superintendence of Captain Butler on behalf of the owners, and the ceremony of naming the steamer *Headley* was gracefully performed by Mrs. Bunclark, of London, wife of Mr. W. E. Bunclark, one of the owners. The *Headley* is the fourth steamer which Messrs. William Gray and Co., Ltd., have built for Messrs. Houlder, Middleton and Co. Mr. W. E. Bunclark and Captain Wm. Butler were present at the lanuch representing the owners.

Carlton.—On December 18th, there was launched from the shipyard of Messrs. Cochrane & Sons, Shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 130 ft. 6 in. by 22 ft. by 12 ft. depth of hold. The vessel has been built to the order of Messrs. T. C. & F. Moss, of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes and Co., of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Carlton* by Mrs. T. C. Moss, of Grimsby, wife of one of the owners, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Euphorbia.—On December 18th, Messrs. Wm. Doxford and Sons, Ltd., Pallion, launched a well-modelled turret steamer, built to the order of The Stag Line, Ltd. (J. Robinson and Sons). North Shields. The vessel is specially designed for the free stowage of cargo in bulk or piece, and to this end is constructed on the clear hold principle introduced a short time ago by Messrs. Doxford. The principal dimensions are, length, 366 ft., breadth, 50 ft., moulded depth, 26¼ ft. The highest classification of the British Corporation has been assigned to the vessel. The deadweight of cargo and bunkers carried is 6,600 tons on a draught of 21 ft. 9 in. Messrs. Doxford are supplying the engines and boilers. The name *Euphorbia* was gracefully given to the vessel by Dr. Amy Robinson.

Myra Fell.—On December 18th, Messrs. Irvine's Shipbuilding Dry Docks Co. launched from their shipyard a finely modelled steel screw steamer built to the order of Messrs. The Thessler Shipping Co., Ltd., West Hartlepool. The vessel is of the following dimensions, 336 ft. by 47 ft. by 24 ft. 10 in. The vessel is built to Lloyd's highest class under special survey and is of the single deck type, having poop bridge and topgallant forecastle. A double bottom is fitted throughout on the cellular principle and the fore and aft and peak tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stransons, giving clear holds for the storing of bulky cargoes. The watertight bulkheads divide the holds into six watertight compartments and wood grain divisions are fitted in the holds. She also has extra large hatches, steam winches which are supplied with steam from a vertical multitubular donkey boiler and is replete with all the latest improvements for rapid loading and discharging. A powerful quick-working steam windlass is fitted forward for the working of the cables and steam stearing gear is fitted amidships with hand-screw gear aft. Accommodation for captain and officers is arranged in houses on the bridge, and the seamen and firemen under top-gallant forecastle. The sanitary, ventilating and lighting arrangements have received special attention and have been effected on the most approved lines. Triple expansion engines are being supplied by Messrs. Richardson, Westgarth and Co., Ltd., Hartlepool, having cylinders 24 in., 38 in., 64 in by 42 in. stroke, 2 large S.E. boilers, 160 lbs. pressure. The christening ceremony was gracefully performed by Mrs. Jacob Thessler, wife of the managing owner, who named the vessel *Myra Fell*.

LAUNCH—Scotch.

Sunlight.—On November 29th, there was launched from the yard of Messrs. Napier & Miller, on the Clyde, a sailing vessel, built to the order of Messrs. Lever Bros., Ltd., of Port Sunlight, which has been specially designed to carry oil in bulk or general cargo, and will carry about 2,200 tons on a light draught of water. The vessel is 230 feet long with a beam of 37 feet, and has been fitted with nine bulkheads, as well as a fore and aft division in the oil space, forming ten oil compartments, as well as general cargo 'tween decks and forehold and two peaks. A large boiler has been fitted with feed and general donkey pump, also two powerful duplex double-acting pumps for dealing with oil cargoes, which can be rapidly discharged, also steam winch for working general cargoes and windlass and capstan for handling the vessel. A fresh water condensing plant and exhaust tank have also been fitted. The crew are housed in the forecastle and the captain and officers in the poop, and room has also been provided for apprentices. The vessel, which will be rigged as a barque, was gracefully launched by Mrs. Tillotson, wife of Mr. Tillotson, the General Manager of Messrs. Levers' firm, was named the *Sunlight*, and has been built to the specification and under the superintendence of Messrs. Flannery & Given, of Liverpool, London and Rotterdam.

LAUNCH Irish.

Salaga. -On December 15th, Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their South yard a handsomely modelled steamer, built to the order of Messrs. Elder, Dempster & Co., of Liverpool. The new steamer has been named *Salaga*, and is 395 feet long, with a gross tonnage of about 4,000. The four cargo holds have been specially arranged for the reception of the largest type of consignment, such as boilers, locomotives and general machinery, being almost quite free from obstruction, and having large hatchways. Each of these hatches is equipped with two winches of the largest and most powerful type, and three strong derricks, which are swung from the masts. The bottom of the vessel has been constructed on the double bottom system, which adds to the strength and safety of the vessel in case of grounding, and is also available for carrying water ballast for trimming purposes. Accommodation for first-class passengers is arranged in the bridge house, with a commodious dining saloon at the fore end. The state-rooms are large and comfortably furnished apartments placed at each side of the vessel. An entrance hall and lounge, with a comfortable smoking-room adjoining has been arranged on the bridge deck, and is approached by a stairway from the saloon passage. Apartments for second-class passengers, including saloon and state-rooms, are arranged further aft on the upper deck. Rooms for the officers and engineers are placed along each side of the vessel at the after end of the bridge space. The crew's quarters are in the forecastle space and include mess rooms for the firemen and seamen. The engines and boilers, consisting of a set of triple expansion engines with all the latest improvements and three single ended boilers have been constructed in Messrs. Workman, Clark & Co.'s Queen's Road Works.

TRIAL TRIPS.

Ben Lomond.—On November 22nd the handsome steel screw steamer *Ben Lomond* (of which we gave particulars in our November issue, page 135), built by Messrs. Wm. Gray & Co., Ltd., West Hartlepool, for Messrs. John Morrison and Son, of Newcastle, was taken to sea for her trial trip. Amongst those on board were—Mr. J. Morrison, sen., Mr. M. Morrison, jun., Mr. Thos. A. Reed, M.I.N.A., of Cardiff (under whose supervision the ship and her machinery have been built), Captain J. E. Murrell, shipyard representative, and Mr. Wm. Reynard from the engine works. The trial was a very successful one, a speed of 11 knots being averaged, and the performance of both ship and machinery giving entire satisfaction. On its conclusion, the vessel proceeded on her voyage to Newport, Mon., where she loads for the River Plate.

Linda Fell.—On November 26th the new steel screw steamer *Linda Fell* (of which we gave particulars in our November issue, page 135), launched by Irvine's Shipbuilding and Dry Docks Co., Ltd., and built to the order of Messrs. The Hessler

Shipping Co., Ltd., West Hartlepool, proceeded to sea on her trial trip. After adjusting the compasses the vessel ran a series of trials, and a mean speed of 11¼ knots was obtained, the engines and ship giving great satisfaction. She then proceeded to Middlesbrough to load.

Djerv.—On November 27th the screw steamer *Djerv* (of which we gave particulars in our November issue, page 138), built by the Antwerp Shipbuilding Co., went on her official trial trip on the measured mile off Whitley, this vessel having been built to the order of Mr. Andreas Gjersoe, of Trondhjem, Norway. The trial, which was run after the vessel had been loaded at Blyth, was in every way satisfactory, the vessel running 9·8 knots per hour in somewhat heavy weather with a strong westerly wind blowing. An evaporator and feed-heater are fitted on board, and all the deck machinery exhausts return to engine-room. The machinery and ship have been classed to English Lloyd's and Norwegian Veritas, and carries an exceptional amount of spare gear. The engines and boilers have been built by the North-Eastern Marine Engineering Co., of Sunderland.

Helredale.—On November 27th the large screw steamer *Helredale* (of which we gave particulars in our December issue, page 169), built by Messrs. R. Craggs & Sons. Ltd., Tees Dockyard, Middlesbrough, and engined by Messrs. Blair & Co. Ltd., Stockton-on-Tees, for the Helredale Steam ship Co., Ltd., (managers Messrs. Thomas Turnbull & Son of Whitby) proceeded to sea for her official trials. The results were pronounced entirely satisfactory to all concerned.

Marlwood.—On November 27th Messrs. Osbourne, Graham and Co. sent to sea for her official trial trip the steel screw steamer *Marlwood* (of which we gave particulars in our November issue, page 134), which vessel they have specially constructed for Messrs. Wm. France, Fenwick & Co., Ltd., of Sunderland and London for their well-known trade. The trial was in every way satisfactory, a mean speed of well over 11 knots being easily attained. After the trial the vessel proceeded on her first voyage.

Flawyl. On November 28th the new steamer *Flawyl*, built by the Sunderland Shipbuilding Co., Ltd., was taken to sea on her official trial, the principal dimensions are 346 in., length between perpendiculars by 50 ft. 8 in. broad by 25 ft. 8 in. deep, having poop, bridge and topgallant forecastle, classed 100 A1 Lloyd's, under special survey, dead weight capacity 6,200 tons. Accommodation is placed on the bridge for officers and engineers, and for sailors and firemen in forecastle; the saloon is in a deck house at the fore end of bridge, and is fitted up in hardwood with berths for captain and officers. A large marine type donkey boiler is supplied for working the deck machinery, which consists of eight steam winches, steam steering gear and direct steam windlass. The machinery has been supplied by the North Eastern Marine Engineering Co., Ltd., Sunderland, and has cylinders 24 in., 40 in. and 66 in. by 45 in. stroke, with two large boilers. The vessel has been built to the order of Messrs. W. Tulley & Co., of Hull, Mr. Richardson, of Hull, consulting engineer, under whose superintendence the vessel was built, was present on the trial trip, and expressed himself as highly satisfied with the efficient working of the machinery and the speed result obtained.

Invertay.—On December 1st the fine steel screw steamer *Invertay*, built by Messrs. W. Dobson & Co., Low Walker-on-Tyne, to the order of Messrs. Law, Leslie & Co., of London, left the Tyne for her official trial trip. This vessel, which has been built to take highest class at Lloyd's, is of the three deck type, with two decks and complete shelter deck laid. The length between perpendiculars is 379 feet, breadth 50 ft., and depth moulded to upper deck 28 feet, and she has been built on very fine lines and large power to obtain a good speed at sea. The propeller machinery, which has been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their patent type of triple expansion engines, having cylinders 26 in., 42 in., 72 in. with a stroke of 48 in., steam being supplied by three large steel boilers working at a pressure of 180 lbs. per sq. inch, and fitted with Howden's forced draught. On the trial run over the measured mile off Whitley the engines worked without the slightest hitch, and a mean speed of 11½ knots was easily maintained, and gave great satisfaction to all concerned. Amongst those present were Mr. Law and Mr. Leslie, managing owners, Mr. Jas. Hunter, under whose supervision both hull and machinery have been constructed, Mr. H. and Mr. W. Dobson, representing the shipbuilders, and Mr. D. Myles, representing engine builders.

John O. Scott.—On December 4th the fine steel screw steamer *John O. Scott*, built by Messrs. Wood, Skinner and Co., Ltd., of Bill Quay-on-Tyne, to the order of Messrs. J. O. Scott & Co., Newcastle, left the Tyne for her official trial trip. This vessel, which is of the long raised quarter deck type, with bridge and topgallant forecastle, and has specially large hatches for self-trimming, has been built to the requirements and under the special survey of Lloyd's Register for their highest class. The propelling machinery, which has been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple expansion engines, having cylinders 18½ in., 30 in., 49 in. by 33 in. stroke, steam being supplied by a large steel boiler working at a pressure of 180 lbs. per square inch. On the trial run a very satisfactory speed was maintained, the machinery working without the slightest hitch and giving entire satisfaction to all concerned. Amongst those present were Major Harvey Scott, managing owner, Mr. Norman Burnett, under whose supervision both hull and machinery have been constructed, Mr. Skinner and Mr. Leslie Skinner, representing the shipbuilders, and Mr. D. Myles, representing the engine builders.

Westland.—On December 4th this vessel, which has been built by Messrs. Rykee & Co., to the order of The Shipping Co., of Rotterdam, was taken on her trial trip and attained a speed of over 10 knots on four runs on the measured mile. The vessel is of the self-trimming type, and is intended to be thoroughly up-to-date for the coal trade, special attention having been given to apparatus for quick handling of both cargo and the large supply of water ballast provided for. Her dimensions are 230 ft. long by 34 ft. 4 in. broad by 17 ft. 1 in. depth of hold, and she has been constructed to obtain Lloyd's highest class. The machinery has been built by Wilton's Engineering and Slipway Co., and has been constructed, together with the hull, under the inspection of Messrs. Flannery & Gregson, of Rotterdam, London and Liverpool. The engines are of triple expansion type, having cylinders 17½ in., 28 in. and 45 in. by 36 in. stroke, taking steam from two large boilers 11 ft. 10 in. by 10 ft. 3 in. diameter, working at a pressure of 180 lbs. The vessel is built to carry 1,700 tons on a light draft.

Mercury.—On December 5th the S.S. *Mercury* (of which we gave particulars in our December issue, page 171), built at the Ayr Yard of the Ailsa Shipbuilding Co., Ltd., went on her official trial up the Firth. She has been built to the order of Messrs. J. & P. Hutchinson, Glasgow, for their Continental trade, and the machinery has been constructed by Messrs. Hutson & Sons, Ltd., Kelvinhaugh, Glasgow. Throughout the trial the performance of the vessel and machinery was highly satisfactory.

Camphill.—On December 7th the S.S. *Camphill* (of which we gave particulars in our December issue, page 169), built by Messrs. Ropner & Son, Stockton-on-Tees, and engined by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, to the order of Messrs. Macbeth & Co., Ltd., of Glasgow, made her official trial trip in the Tees Bay, when she attained an average speed of about 11 knots per hour. The trial trip passed off in every way very satisfactorily. The owners were represented by Mr. Scott and Captain MacKenzie. Mr. J. R. Gartwaite was present on behalf of the builders.

Ellaline.—On December 8th the new screw steamer *Ellaline* (of which we gave particulars in our December issue, page 169), built and engined by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of Messrs. Hutchins Brothers, Cardiff, was taken to sea on her official trial trip, which was in every way successful and satisfactory to all concerned, a mean speed of over 11 knots being attained, and the vessel afterwards proceeded to Cardiff to load. During construction the vessel has been superintended by Mr. A. J. Marquand, of Cardiff.

Henrik Ibsen.—On December 8th the fine steel screw steamer *Henrik Ibsen* (of which we gave particulars in our November issue, page 135), built by Sir Raylton Dixon and Co., Ltd., of Cleveland Dockyards, Middlesbrough, for Herr Wilhelm Sorkildsen, of Bergen, Norway, proceeded to sea for her official trials, which passed off most successfully. Afterwards the vessel proceeded to Cardiff under the command of Capt. J. S. Reinirtsen, at which port she will load a cargo for Chili.

Lindenfels.—On December 11th the S.S. *Lindenfels* (of which we gave particulars in our December issue, page 169), built and engined by Swan, Hunter & Wigham Richardson, Ltd., for the Deutsche Dampfschifffahrts Gesellschaft "Hansa" of Bremen, sailed from the Tyne after a very successful trial trip. The engines worked without the slightest hitch, giving satisfaction to all concerned. The owners were represented on the trial trip by their superintending engineer, Mr. D. Wulff, of Bremen, and immediately on the conclusion of the trial the vessel proceeded on her voyage under the command of Capt. Kenneweg.

Venture.—On December 11th the steam trawler *Venture* (of which we gave particulars in our December issue, page 171), just completed by Earle's Shipbuilding and Engineering Co., Ltd., to the order of Mr. G. Blashill, of Hull, was taken for her official trial trip. The vessel left the builders' dock on the early morning tide and anchored in the river, the officials and visitors boarding her off the Victoria Pier at 8.0 a.m. She then proceeded to the measured mile at Sunk Island, where the full speed trials were run. These proved highly satisfactory to all concerned, a mean speed of 10¾ knots being attained, the engines working easily and the boiler developing ample steam pressure. After a very successful trip the vessel returned in time to berth in St. Andrew's Dock on the afternoon tide. The owners were represented by Messrs. B. Glashill, J. Harrison and E. Batchelor, and the builders by Messrs. J. L. Read (engineers department) and L. Cubley (ship department). Amongst the visitors present were Messrs. J. Barclay (Lloyd's), T. Boyd, H. Hall, R. Skelton, H. Blashill and T. Slingsby.

Utgard.—On December 14th the fine steel screw steamer *Utgard* (of which we gave particulars in our December issue, page 170), built by the Northumberland Shipbuilding Co., Ltd., Howden-on-Tyne, and engined by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, to the order of Messrs. The Midgard Deutsche Seeverkehrs Aktiengesellschaft, of Bremen, left the Tyne for her trial trip, it being the fourth vessel built by the Northumberland Shipbuilding Co., Ltd., for this company, who have another vessel at present building for the same owners. The vessel during the period of construction has been under the supervision of Mr. G. Bahr and Mr. H. Reike. Mr. Deitrich has supervised the construction of the engines and boilers on behalf of the owners. The trial trip proved in every way satisactory and a speed of 11½ knots was easily obtained. The vessel afterwards returned to Tyne Dock to load for Savannah under the command of Captain Wurthmann. Among the guests on board were the following:—Mr. G. Bahr, representing the owners, Mr. J. Graham, representing the builders, and Mr. Harrison, representing the engineers.

Magdala.—On December 15th the large screw cargo steamer *Magdala* (of which we gave particulars in our December issue, page 171), built and engined by Messrs. David and William Henderson & Co., Ltd., Partick, to the order of Messrs. Maclay & MacIntyre, of Glasgow, underwent a successful trial trip on the Firth of Clyde. The trials were in every way successful and gave entire satisfaction to the owners and builders. A mean speed of about 13 knots was easily attained on the run from Cloch to Cumbrae.

Corunna.—On December 18th the large steamer *Corunna* (of which we gave particulars in our December issue, page 169) ran her official trial trip off Hartlepool, which proved in every way satisfactory. She is to the order of Messrs. The Agincourt Steamship Co., (Messrs. Lloyd & Co., manager), London, by Messrs. Furness, Withy & Co., Ltd., Hartlepool. The main engines and boilers by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, worked efficiently throughout the trials.

Holland.—Lately Messrs. Doxford & Son took out for trial trip from their yard at Sunderland a turret vessel of the beamless type to the order of Messrs. F. Drughorn, Ltd., of London, ander the superintendence of Messrs. Flannery, Baggallay & Johnson, of London, Liverpool, and Rotterdam. The vessel is 350 feet long with a beam of 50 feet, and carries a large cargo on a light draught, and will be fitted with engines having cylinders 25 in., 41 in. and 66 in. and a stroke of 45 inches, and steam will be supplied from two large boilers. The vessel is being fitted with a very large donkey boiler and the hatches and cargo gear have been arranged for rapid working of cargo by eight powerful steam winches. A mean speed of over 10 knots was attained.

Naval Appointments, Launches, etc., are held over for want of space.

REVIEWS.

Elementary Manual on Applied Mechanics. By Andrew Jamieson. London: Charles Griffin & Co. 1906.

THE author, in this, the seventh edition of his work, says he endeavours to meet the general requirements of students for all examinations of any kind whatsoever, and by his treatment of the subject, we should think his claim is a just one. He treats the matter in the way of lectures, and to readers of the class he aims at, this method seems to appeal. Explanations are short and concise, while the illustrations are simple and graphic. The average student knows what he wants, and the issue of several editions goes to prove that the necessary instruction is found in these pages. There is said to have been considerable enlargement made by the addition of further apparatuses, some of which we may refer to.

Turning to the body of the book, the question of force finds a first place, followed by that of work, with numerous examples. Then comes horse power, and what that means; with this basis to rest upon, the principle of moments is dealt with, and we have the simple fact of a lever closely studied, with many of its applications. Among these is the steelyard, the safety-valve, bell-crank, tongs, pincers, and toggle-joint. More complicated examples are found in the wheel and axle, winch-barrel, ship's capstan, and watch-spring. The question of pulleys is dealt with separately, and we have these in the form of a snatch-block, block and tackle, Chinese windlass, and differential pulley block. All these are treated, showing the forces acting to produce results. It is only after this that the author goes into the question of forces in equilibrium, and the triangle and parallelogram of forces. He then illustrates these principles by a jib crane, a simple roof, and inclined planes. Next the important question of friction, with the laws appertaining thereto, is noticed, and experiments illustrating the same. Belt-gearing, with various forms of driving, make up one lecture, and wheel-gearing another; but the practical side of the question is kept well before the reader, who has a rack-and-pinion and the gear of a triple-purchase winch presented to him first, followed by winches and cranes. The next subject touched on is that of screw, thread, and tables of Whitworth standard rivets and bolts. As further examples of screws, we have a bottle-jack, a bale-press, a bench-vice, and worm-wheel lifting-gear. Lathes have an unusually long chapter devoted to them, with the principles and results of heavy cutting explained and tabulated. Hydraulics, with the laws appertaining thereto, go to make up one lecture, and this leads up to floating bodies, and the pressure exerted by water on a wall, for example. Hydraulic machines bring us to pumps of different varieties, both piston and centrifugal. Hydraulic presses follow, and then jacks, bears, and accumulators. There are also experiments shown to illustrate centrifugal force, falling bodies, and fly-wheel energy; while there is a new chapter, for instance, on torque, or twisting, moment. We cannot enumerate all the experiments found here, and must leave our readers to study the book for themselves. It will repay them. A lecture we ought, perhaps, not to fail to notice, is that to do with cams and universal gearing. Here prawls and ratchets have a place. The appendices are valuable, in that they give information respecting examinations and papers set. The book is not bulky, and yet it contains much that is most valuable in a succinct form.

The Schulz Steam Turbine for Land and Marine Purposes. By Max Dietrich. London: A. Owen & Co. 1906.

THE author in this case is described as an officer of the German Navy, who, while not professing to put forward any particular system from the title, must necessarily confine himself chiefly to the one type. He says that on this system only is the steam pressure so regulated either by hand or automatically that full use can be made of it, even for a minimum of work. He also says that the work is regulated at each expansion stage. This is when speaking of the action type of this make, and when referring to the reaction machine he also claims advantages that the end thrust is taken up in a simple manner, and that the length is less than other makes of this class of machine and without any loss in efficiency. We have before us designs of the first turbines constructed on this principle, and also a compound turbine. The examples appear to be derived from following ont the patent specifications in the order the various apparatus was devised. We are enabled, notwithstanding, to follow pretty clearly the development as it took place, the author showing us how the problem of reversal and the elimination from end thrust were obtained. He then follows with the means adopted for securing a proper supply of steam at each expansion stage, and we also, at this point, begin to have details which may be described as working ones—the system of packing, for instance. As far as we are enabled to form an opinion, makers of this class of machinery have a formidable competitor in Schulz. The design of a full machine on page 35 is of a very practical character in every way. Indicator diagrams are taken from it, though they are different to what we are usually accustomed to. Notice is taken of disputes between Parsons' and the inventor under notice as to priority of rights, and we find a good deal of criticism of some Parson's designs for marine purposes leading, it is said, to want of fuel economy. The author puts forward the principle that there must be a continual fall of pressure to obtain the best available energy. He says this is done by Schulz, and that this machine works at every speed with nearly constant boiler pressure. It will be gathered from what we have said that the author holds a brief for the system he describes, and presses it with all the skill of the barrister endeavouring to win his case. He starts by assuring us he is open-minded on the matter, but he allows few points to any other type. If he concedes anything it is to the De Lavat type. It must be allowed, however, that his illustrations and descriptions permit of a very clear understanding as to what the Schulz system really is, and whether we agree or not to all the conclusions drawn here, anyone charged with turbine design or construction cannot fail to derive benefit from a perusal of these pages. The author's partisanship does not detract from the value of the contents, and it must be remembered he was called on to give an exposition of the system under notice.

Know Your Own Ship. By Thomas Walton. London: Charles Griffin & Co. 1906.

IN the preface to the ninth edition, which this is, the author says he has entirely re-written and enlarged the chapters on tonnage and freeboard, owing to the changes continually being made, and that he has thoroughly brought the work up-to-date in every way. That it has gone through so many editions is evidence in itself of the value attached to the several issues, and when we peruse the pages again, we are constrained to be reminded of the cause of the success attained by the simplicity which characterises the whole. The author has bee enabled to hit the happy medium, and strikes at the heart of the subject, without being diffuse or carrying the average reader out of his ordinary depth. He introduces us first to the definitions, and shows us what a displacement curve means, what a moment signifies, buoyancy, and the effect of water pressure on a ship's form. With the principles thus fully explained, we find the questions of strain on a hull gone into, in light and load conditions, and on waves, and in the trough of the sea, as well as the general circumstances attending the everyday life of a ship. Under the heading, "Structure," we find the method of building up a hull described. There are the dimensions of framework and plating for vessels of different sizes, according to Lloyd's rules, the local stregthenings necessary for machinery spaces, under engines and boiler-stool. The author is graphic in his illustrations. We are not left in doubt anywhere as to his meaning; and whethzr he gives us a midship section with cellular double bottom, or shows us the compensation allowed for reduction in depth under boilers, we are at all times clear as to the intention wished to be conveyed. For instance, the strengthening of ship at after end, where the propeller is fitted, is an important matter. It is all seen here. The choice of a particular type of vessel for different classes of cargo is closely described. The question of bulk heads is not neglected, also with watertight doors, and some notice of riveting.

For the shipbuilders and the ship's captain stability is a problem of the greatest concern. The latter, being in charge of the loading of the vessel, thereby influences the safety by means of the alteration in stability caused by variations from the general design. The matter is all thoroughly explained, with curves of stability under various conditions of design and load. In the second section, the author shows us the effect that a seaway has upon the vessel, as distinct from still water, and the graphic style of his methods is shown by the fact of a vessel being seen in comparison with a raft, on the crest and trough of the waves, the advance being sideways.

Ballasting, as is well known, is an important feature of a ship's oversight, which, if not properly attended to, has led to many losses. Naturally we follow on to water ballast and double bottom for this purpose. The author is very complete on this problem of a ship's loading, and will be found instructive, not only to ships' officers, but to students and those engaged on design. He shows us a vessel in all degrees of inclination, till at last her margin of safety has vanished entirely. Having gone into the various phases of the stability question, however, we still have a chapter on loading, specially intended, no doubt, for masters and those charged with the care of the vessel. We have the question of shifting cargoes studied, as well as the admission of water into the interior of the structure. The effect of sails is noticed, and also the alteration of trim, caused by moving weights forward on a ship's deck. Another chapter is devoted to tonnage specially, and we find complete information on nett and gross tonnage and exemptions, with methods of measuring. Freeboard is another chapter replete with information, and we see how the marking is made. Several examples are given; and in the last chapter of all, special calculations are made connected with a naval architect's work, which we need not enumerate. Suffice it to say that nothing appears absent that we should expect to find. Both author and publisher have joined hands in producing what is probably the most simple and, withal, complete volume on ship construction ever introduced, and it is, therefore, not a matter for surprise it meets with such approval.

Institute of Marine Engineers.—Lord Pirrie, president of the Institute of Marine Engineers, was present on December 7th at a Bohemian concert given at the Institute premises. 58, Romford Road, E., by Mr. James Adamson and Mr. Bertram, the hon. secretary and hon. minute secretary respectively. In the course of the evening Lord Pirrie presented to Mr. Robert Mackenzie the "Denny" gold medal, which has been awarded him for his paper on "A Three-stage Collecting and Compressing Machine for CO_2." In making the presentation he remarked that the subject upon which Mr. Mackenzie had written was both a technical and a theoretical one, and he had very great pleasure in presenting the medal. Mr. Mackenzie fittingly acknowledged the presentation. Lord Pirrie then presented the prizes which had been given by Mr. A. E. Battle for the best essays written by graduates of the institute on a visit to the Engineering Exhibition at Olympia. The prizes had been awarded to two young engineers, Mr. Walter Smith and Mr. William Wallace Adamson, who had sent in their essays under the pen-names of "Veritas" and "Vulcan." Mr. W. W. Adamson, who is the son of the honorary secretary, is engaged in the drawing office of Messrs. Denny, of Dumbarton, and in his absence Lord Pirrie handed the prize to Miss Nellie Adamson, his sister. The musical programme was carried out in a pleasing manner, several of the singers being heartily encored. At the close of the evening Mr. T. F. Aukland proposed a vote of thanks to the president. Lord Pirrie, in acknowledgment, expressed the hope that the meetings of the institute would be as great a success in the future as in the past. He intended, he said, always to take a very great interest in the Institute of Marine Engineers.

Engineers' and General Smiths' Work. By Thomas Moore. London: E. & F. N. Spon, Ltd. 1906.

THIS book, which is of a comprehensive nature, is put forward as the smith and foregman's handbook; and, in these days, with everything of a technical character commanding support when put into print, we should say this subject, which we do not remember to have seen dealt with before, is likely to receive attention. The author is a practical smith, and his sketches of forges, to begin with, enable us to see the appliances necessary. They are of various types, with the fans for blowing. Then there are the anvil and swage-block, the hammers and tongs, and many minor details required in the smithy, which need not be enumerated. Tney are all noted here, and generally the methods of making them. On the question of special tools, the steam hammer is given a great prominence, as taking the lead over power hammers and stamps. With steel to the front, as it is, the author gives some description of this material, and the mode of manufacture and working up. We have the process of the former here, so that readers can see for themselves what the various systems are right up to the present-day high-speed tool steel. The tests that steels have to undergo nowadays are thoroughly explained and illustrated; and it is seen that these are by no means a small matter. As part of a smith's curriculum, we are shown how to forge bolts, for example, in their various forms. A tradesman must be an expert to know all that is to be found here in this branch. It is understood that machines make many of the forms to-day, but the smith has to be relied on for the out-of-the way types. Collars are not an easy job to undertake; washers and ferrules are similar in construction. The making of spanners is also described here, with due variety. Links and levers are discussed, also carriers for lathes, forks, stanchions, chain-hooks, hoops of various sections, with many other general engineering requirements.

The author then proceeds to describe a tuyere, and what is the want of such an appliance. The superior side of smiths' work may be said to begin at this point in the book; and we are told what annealing is, and the bending of metal a smith is called on to carry out, and how he does it—a by no means simple matter, when we consider the numberless shapes that have to be made with the tools required. We find the index method adopted in this second part, and it is, therefore, easy for a reader to turn up his requirement under the proper heading. Finally, there are tables that are wanted in the trade. We have sizes of bolts and nuts, for instance, diameters, and circumferences of circles to 1-16th inch, areas and weights of round and square bars, and many others. There is likewise a good index at the end. Without our saying any more, it will be gathered that we have here a very wonderful commentary on smiths' work, and we can follow the author readily in all he puts forward. The book should prove most useful to students and young men wishing to study what they see carried out around them in the forge, where a good all-round trade is done.

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The Marine Engineer
And Naval Architect.
LONDON, FEBRUARY 1, 1907.

THE proposals for the construction of a Channel Tunnel, after lying quiescent for many years, have again been brought vigorously forward. The objections which caused the matter to be dropped on previous occasions seem to us to be as strong, or if possible stronger, than they were before. For one thing, a new defect has been brought into the promoters' case in that they suggest that—as there seems no reasonable probability that the thing, if carried out, would be a commercial success—they would have the French and British Governments join in financing the scheme. That alone ought to be fatal to the proposal. State and Municipal enterprise has run mad enough already, and the over-burdened taxpayer cannot be expected to find the money for this new departure. It is a scheme which after reasonable consideration no impartial person could support. No doubt the thing is feasible to the modern engineer if he be granted unlimited credit. It is said that sixteen millions sterling will cover the cost. But we should be very much surprised—judging by the data afforded by the construction of the London tube railways—if double that sum would really pay for it. Remembering there would still be alternative routes in the existing steamship services, the amount chargeable for fares and freight would be limited, and it becomes therefore impossible to see how the traffic to be borne over two lines of railway could be made to cover the capital charges and working expenses. Quite apart from military considerations we should be prepared to maintain that the people of this country and of France cannot be expected to find the money for a scheme of this kind, even if the prospectus shewed a paper profit. When the probabilities are against anything except loss on working, there are a thousand good reasons against the proposals.

The one point in favour of those who suggest the undertaking is the fact that the tunnel would avoid the changes from railway to steamer at Dover and from steamer to railway at Calais. We doubt whether the traffic through these ports is such, or within a reasonable period could be developed into being such, as would justify so large an expenditure. But we have a counter proposal in the Channel Ferry Scheme, which has already obtained Parliamentary sanction. We know that railway ferries exist both in the Eastern and Western Hemispheres, that they are working every day and every night over longer and stormier routes than those across the English Channel, and that they in every way give satisfaction to those who work and travel by them. A Channel Ferry is open to no military objections. It could be provided for a sum not exceeding a million sterling—which is a drop in the bucket beside the cost of a tunnel. The Channel Ferry would enable fragile goods to be carried from the inland English towns where they are manufactured to their destination in the Continent, without transhipment at Dover and Calais, just as surely as could the proposed tunnel. So, too, passengers would avoid the discomfort of detraining, hand baggage in hand, on a cruel winter's night, with a rush down the wet or snowy quay to the steamer and the prospect of a similar experience at the end of the sea voyage. The objections to the ferry are simply passenger objections. They are inferiority in speed, and possibility of sea sickness. Both these objections appear trifling on examination. A fast turbine steamer will cross the Channel well within the hour. The saving to be attained by the construction of the tunnel is therefore but an affair of minutes. Sea sickness would be even less than at present in the big ships which would carry the international passenger trains.

Against the sea sickness may be put the long time to be spent under the sea in an imperfectly ventilated tunnel. It may well be argued that a short crossing in a good steamer is less trying to nervous people—who are generally those who are sea sick—than a long submarine journey. When the thing is thought out one sees that the prevention of sea sickness is the one advantage which the tunnel scheme can offer. Is it worth fifteen millions—the difference in cost between the tunnel and ferry proposals—to abolish sea sickness on a single route, and that a short one? Surely we are justified in asserting that unless a facility can be shown to possess the potentiality of making a return to those who find capital for it, it is not within the bounds of commercial practibility. The return of which we speak need not necessarily be in hard cash, it may be in some other desirable form. But in the present instance it is abundantly clear that the tunnel offers no real advantage which cannot be attained by other means at less than a tithe of its cost. That being so the promoters are surely out of court on their own case.

THE advantages of the turbine system of propulsion, which have been so triumphantly demonstrated by the trials of the *Dreadnought*, are being fully acknowledged by Foreign Powers. The early recognition of the benefits following on the adoption of this system by the engineering authorities at the Admiralty has given this country an immense lead; a lead which it seems possible might have been still further increased had the advice of Sir Philip Watts been taken when the Lord Nelson class of battleship was designed. As it is, Great Britain will have the *Dreadnought* and her sisters, with the *Invincibles*, in the water and ready for service long

before any Foreign Power can have similar turbine propelled ships afloat. France, after having made inquiries by a commission in this country, has decided to abandon the reciprocating engine for her six new battleships, and all of them will be fitted with the Parsons' turbine. In Russia, also, it has been definitely decided that the new vessels, including two "Dreadnoughts" to be built at St. Petersburg, shall be fitted with the turbine system. So far as Germany is concerned, it is almost certain that she will follow England's lead in this matter; for her naval engineering department have fully satisfied themselves by the experiments with small craft, that the advantages claimed are capable of attainment. The substitution of the turbine for the reciprocating engine in the man-of-war ensures a gain in efficiency and economy of weight, space, and fuel consumption, not so much perhaps at low power at present, but this should also be achieved when suitable cruising turbines can be fitted. There is no question of the high propulsive efficiency attained, or efficiency so far as the manœuvring powers are concerned, but in addition there is greater security against a complete breakdown, and again, it is extremely likely that a smaller proportion of staff and *personnel* will be required. The last named is apparently regarded in America as as much an inducement to use the turbine system as any, and although it is not yet settled that the new ships are to have turbines, the plans for providing them with this system of propulsion have been submitted to Congress alternately with plans for reciprocating engines. The cruise which the *Dreadnought* is now making experimentally to the West Indies will be watched on both sides of the Atlantic with the keenest interest. If she carries out her programme, she will make her two passages across the Atlantic, some 7,500 nautical miles in all, at an average speed of 17 knots, which in spite of the book speeds with which many of them are credited, no other battleship in the world could accomplish. While in the West Indies also, a very interesting and useful series of trials will be undertaken, the value of which as regards future construction, will be immeasurable. Without questioning the usefulness of information obtained from the results in merchantmen, even when they are as large as the *Carmania*, it is quite certain that for warship purposes it is preferable that such information should be obtained from experience with a warship. It is in this way that the Admiralty will profit so largely. Doubtless, too, the naval authorities would be well advised in reserving for themselves the advantage which the possession of such information and data confers. But look at it how they may, the Admiralties of the world's navies have been forced to adopt this form of propulsion by its established success in the *Dreadnought*. The prevision of the British Admiralty has not only given this nation a fifteen months' start, for it must be just about that time since the first rivets of the *Dreadnought* were driven, but with the experience gained in her, each succeeding batch of vessels should be for some time an improvement on anything that Foreign Powers may turn out.

IN this issue appears a notice of the Liverpool Marine Engineers' and Naval Architects' Guild, which has been recently founded for most humane and worthy objects.

The institution of the Guild reflects the highest credit on the promoters, and the kindly thoughts animating them in their desire to form such an association indicates that their hearts are in the right place. In connection with the formation of undertakings such as that referred to, it is usually the case—nay, it almost seems necessary—that there should be one directing spirit to guide and control the details and keep the channel clear that all may flow freely on the appointed course. The organizing work in connection with the Guild has been devised and directed by Mr. H. M. Grayson, M.I.N A.—chairman of the General Committee—of whose labour of love many will doubtless reap the fruit. We have pleasure in giving a photograph of Mr. Grayson, who is Managing Director and principal of the well-known Liverpool shipbuilding and ship repairing firm of Messrs. H. & C. Grayson. We accord to Mr. Grayson and his Committee our meed of appreciation and commend to our readers the new Guild with its aims and objects. The administering of funds is always a difficult matter, especially when the area of distribution is wide, but the methods proposed are wisely ordered and no doubt will be as wisely carried into effect. It may occur to the leading spirits in other ports, who are like minded with these in Liverpool, to found similar Guilds, so that they may be partakers in the noble service of lending a helping hand to the weak and suffering.

Messrs. Matthew Keenan & Co., Ltd.—We are pleased to hear that this well-known London firm of boiler and pipe coverers are making great headway in Scotland, since opening their new branch works and offices at 80, Great Wellington Street, Glasgow. They have secured important contracts for covering with their various compositions the following ships:—2 boats for Messrs. Fratelli, Consulich, Trieste, built at Messrs. Russell's and engined by Messrs. Kincaids; 2 boats for Pacific Steam Navigation Co., Liverpool, building at Messrs. Beardmore's; 4 boats for P. & O. Steam Navigation Co., building at Messrs. Caird & Co., and repairs to s.s. *Isis*; also 1 boat for Messrs. Fairfield, Engineering Co. 1 boat for Royal Mail Steam Packet Co., built by Messrs. Workman, Clarke & Co.; 1 boat for East Coast Steam Navigation Co., Sydney, built by Messrs. Dunlop & Co.; 1 boat for Messrs. Whimster & Co., Messrs. Alexander Stephens (repairs); Bow, McLachlans, electric plant.

In connection with a paper recently read by Mr. Preidel before the Institute of Marine Engineers, Mr. W. J. Harding points out that about 1864 a cylinder enclosing the propeller was fitted to a gunboat at Portsmouth on the proposal of Mr. J. White, of Cowes. The vibration was much decreased by this, and the speed increased slightly, so that there were two improvements brought about by the alteration made. The boat was fitted with horizontal engines.

Henry Mullineux Grayson, Esq., M.I.N.A.

THE SCREW PROPELLER.

VII.*

By A. E. SEATON, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

BEFORE proceeding to examine and analyse the results of further experiments made by the Admiralty and others, it will be well to determine the means at our disposal, whereby we may do so with greater advantage to ourselves than that enjoyed by those who conducted them in the early days. To do this it is first of all necessary to understand clearly what is meant exactly by the terms used, and to make the definition of them clear and precise; hence

A helix. Just as the circle is a plane figure made by a right line of definite length revolving around one end, and its axis at right angles to it, so a true helix is a figure made by such a line revolving around an axis at right angles to itself, at the same time that it advances along that axis at a rate uniform with its angular motion; that is, for every degree of angular movement it slides along the axis a definite distance; if this movement is made spasmodically only, and wholly at the beginning or end of each degree of angular movement, a spiral stair with 360 steps will be formed; if, however, it is moving all the time at a constant rate, both axially and angularly, the surface thus formed is a true helix.

The Diameter of the helix is of course equal to twice the length of the describing line.

The Pitch is the distance the end of the line has travelled along the axis in making one complete revolution.

The Area of Surface is equal to the length of the line multiplied by the distance through which its middle point has moved.

Let "r" be the length of the line A O (fig. 14), "p" the distance A B, moved by one end along the axis, and "s" the space moved through by the middle point.

Then $s^2 = (\pi r)^2 + p^2$

or $s = \sqrt{\pi^2 r^2 + p^2}$

and the area of helix is $s \times r$ or $r\sqrt{\pi^2 r^2 + p^2}$

$= r \sqrt{9.9\, r^2 + p^2}$

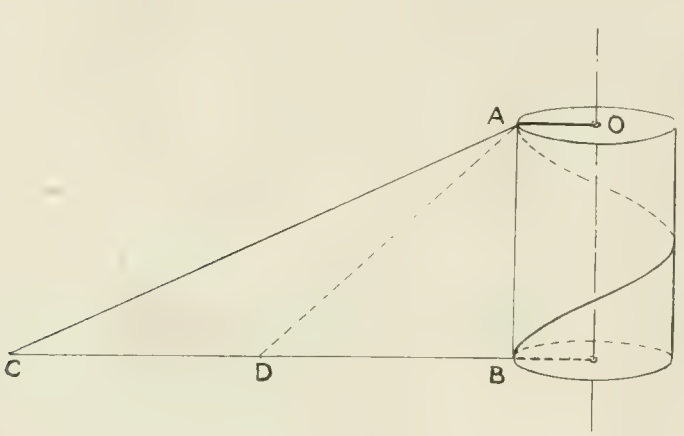


Fig. 14.

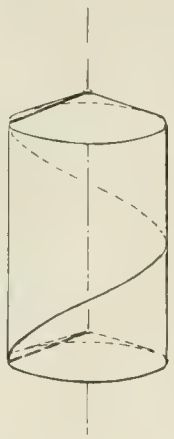


Fig. 15.

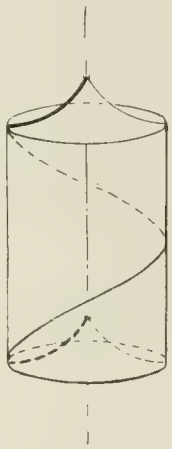


Fig. 16.

A True Screw is one whose acting surface is a portion of such a helix.

A Common Screw is a portion of the helix obtained by cutting it with a pair of parallel planes at right angles to the axis.

Length of Screw is the distance apart of the dividing planes by which the portion is cut off.

Pitch Ratio is the pitch of a screw divided by the diameter.

Conical Helix, fig. 15. If the revolving line be inclined from the axis so that the angle is greater than a right angle, and it moves as before, axially and angularly, the figure so formed is like the surface of an ordinary V thread, the pitch will be the same, but if the describing line was of the same length as before, the diameter will be less, as will also be the surface. Screws are sometimes made with an acting surface coinciding with a conical helix; they are therefore true screws, inasmuch as the pitch throughout is uniform, but the blades are said to be inclined.

A Conoidal Helix, fig. 16, is made by the revolution and axial advance of a curved line instead of a straight one; it may be a portion of the circumference of a circle or of any other curve, and may be placed so that its tangent at the outer or inner end is at right angles to the axis.

On the surface of one or other of these helices, screws can be drawn with any shape or size of blade; but there will be only one blade, inasmuch as there is only one helix. To have two blades there must be two similar helices, and those opposite each other on the axis. Such two helices will be formed by a line revolving about its centre and advancing along the axis uniformly as before.

Varying Pitch Helices.—Bennet Woodcroft, in the early forties of last century, and many other engineers since have advocated and used screws having a variable pitch. Woodcroft's original screw was a helix made by a line revolving at a uniform rate while advancing along its axis at a constantly increasing velocity, so that if p is the initial and p_1 the final pitch, p is the distance which would have been moved through if it moved uniformly at the rate at which it commenced and p_1 that which it would have traversed

* For Articles I. to VI. see August to January issues.

if it had moved the whole time at the rate at which it finished.

The increment per degree then is

$$\frac{p + x}{360}$$

X is a quantity which may increase at a greater rate than an arithmetical progression, but is not necessarily so rapid as a geometrical one. Screws inscribed on such a surface have a finer pitch near the leading edge than at the following; in fact, that of the leading edge is generally that corresponding to the speed of the ship.

Atherton's Screw was made with a pitch varying from the centre to the tip of blades. That is, the surface is formed by a revolving line as before, but instead of always remaining at right angles to the axis it decreases the angle as it advances; that is, the outer end of the line moves at a more rapid rate parallel to the axis than does the inner end along the axis. On any one of these surfaces so formed may be inscribed a blade of any shape, as on the helices of true pitch.

Referring to the spasmodic advance and angular movement whereby a figure like a spiral staircase is formed, it is of interest to know that some of the early screws were made of oak plank cut to shape, as shewn in Fig. 17, and laid one on the other, so as to form this very arrangement; they were bolted through and through, or otherwise secured to form a solid whole; the corners were then chamfered and the whole faired to the surface of a true screw, as shown on Fig. 18. In the early days of small screws their patterns were built up in this way.

The Surface of a Screw, as now understood, is the area of that of the actual blades on the driving side from the outside of the boss to the tip.

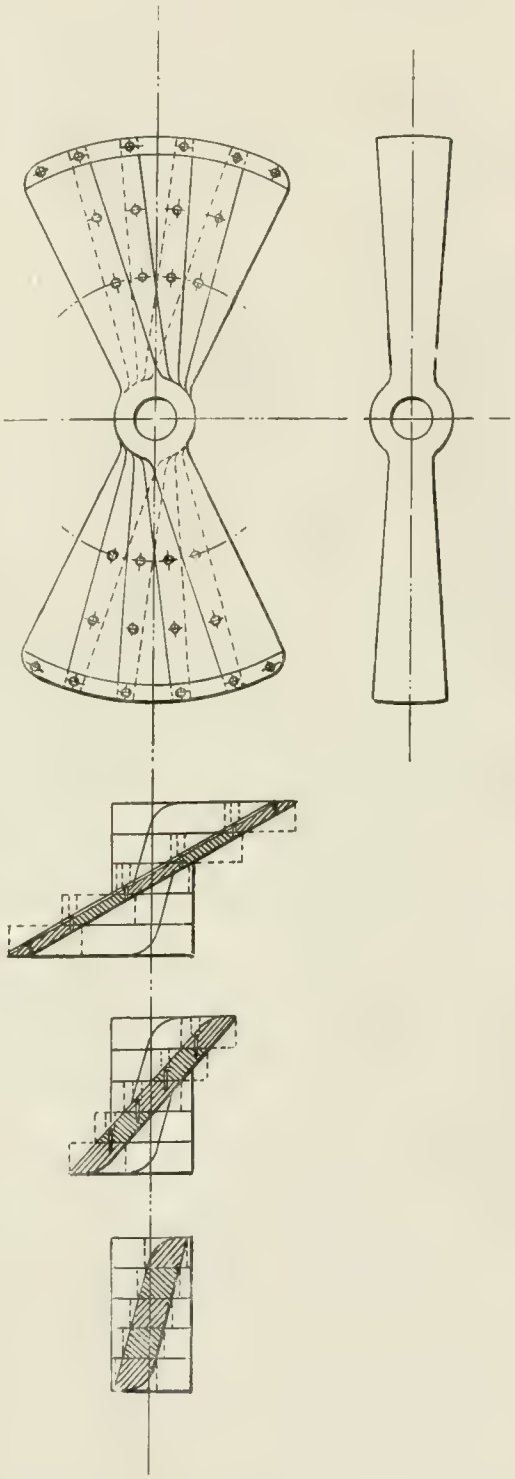
Projected Surface of a Screw is that made by projecting the outlines of the blades on a plane at right angles to the axis; in other words, it is what is seen on looking at a screw from behind with the line of vision coincident with the axis. At one time this was a factor of first importance, as being the measure of the thrust power of the propeller.

Surface Ratio is the area of the surface of all the blades of a screw divided by the area of its disc, that is, of the circle circumscribing it.

Theory of Screw Propulsion. Whatever may have been the scientific views of Mr. F. P. Smith and his friends as to why a screw should cause a ship to move, it did not hinder them from making models and building ships to demonstrate the fact. The screw bolt and nut are of considerable antiquity, and screws have been used to penetrate and be held in platsic material, such as stiff clay for piles, moorings, etc. It is, therefore, not surprising that the screw and nut theory early took root and remains, though in a somewhat languishing condition, to this day; in fact, it is often a convenient way of illustrating certain phenomena to liken the screw to that of an augur or bolt moving in a solid unyielding material.

Professor Rankine was one of, if not the first to place the screw with all other hydraulic machines capable of and engaged in moving water, and attributed the thrust on the shaft of a screw propeller to the re-action from setting a mass of matter in motion; or to put it in a homely way—in order to push the water away from the ship it must have something to push against, *viz.*, the thrust block. Now wherever the water came from this is true, even if the water

Fig. 18. Fig. 17.



was projected through the air above the water level, as was demonstrated when dealing with jet propellers; this would seem to shew that the water may be as a

"nut" in its passage through the screw, but be shattered in fragments after; in other words, the screw is not pushing against the solid ocean, but only on the small portion of it passing through the blades. It is seen in the experiments with the screws for the *Rattler's* trials with the *Alecto* that the long screw with large surface and three blades was not only inefficient in a general way, but that it had larger slip; now if the nut theory were correct this ought not to have happened, because if the screw had not surface enough for the water in contact with it to resist the pressure, there would be good reason for it breaking up, by the blades slipping, but with such large surface as to have quite a small pressure per square foot it ought not to have given way.

Institute of Marine Engineers.—We note from the circular letter issued by the hon. secretary calling the annual meeting of the Institute of Marine Engineers for Friday, April 5th, that the office bearers and council have selected Jas. Knott, Esq., of the Prince Line, as the President-elect, to succeed the Right Hon. Lord Pirrie. It seems fitting that the enterprise and energy which have contributed to the building up of such a fleet as that now owned by the Prince Line should be recognised by the Institute of Marine Engineers, and we may apprehend that the choice now made *is* a recognition, while it is also a tribute paid to Mr. Knott for his success in reaching the position he now holds, as the head of a large ship-owning company.

Lieutenant D. G. Connell, R.N.R.—The saving of life under circumstances which render the feat to the saver one of special difficulty and danger is always worthy of recognition, and we have pleasure in according to the chief officer of the *Chupra*, Lieutenant D. G. Connell, R.N.R., a tribute of praise for his action in trying to rescue three Lascar seamen from death by suffocation and for which he was awarded the Royal Humane Society's medal. The medal was presented to Lieutenant D. G. Connell on January 2nd by John Gray, Esq., representing the owners, on board the ss. *Jelunga*, Royal Albert Dock, London, in the presence of the Superintendents of Departments, members of the staff and the officers (marine and engine) of the company's steamers in port. Captain Henderson, *Jelunga*, presided at the lunch given on the occasion. The circumstances arose owing to a fire which broke out among the cargo on board the *Chupra*, shortly after she left Bombay last October; it became so serious that the ship was turned back to Bombay, where it became necessary to work the anchor and three of the Lascars descended to the chain locker to see to the cable. On reaching the locker, their lights went out and two of the men became unconscious, the other had strength to shout; this called attention to their condition and it was then realized that the fumes from the hold had penetrated the bulkhead. At once the engineers brought the electric light into action and a portable lamp was lowered. The chief officer went into the vitiated atmosphere and got one man up alive, then another, who, however, subsequently died. Lieut. Connell himself was losing consciousness when he was pulled up by the chief engineer, Mr. Alex. McLean, but for whose friendly arm—as he expressed himself after the presentation—he would not have been in the position to receive a medal. In addition to the medal to the chief, one was also awarded to the fourth officer, Mr. Webster, to whom it was sent, he having attempted at the risk of his own life to get the third Lascar out alive: the fumes, however, were too dense for life to exist; the man did not rally and Mr. Webster was helped out of his perilous position by the second engineer, Mr. Jas. McLaren.

A thought suggested by the incidents in connection with the rescue work may be allowed to find expression. It is to the effect that there is a sense of the fitness of things in the two great branches of our maritime service, standing shoulder to shoulder, helping each other, and working together harmoniously for the highest interests of the shipowner, the representatives of commerce and the nation exercising the grace of courtesy and that respect for each other's office, which is the best guarantee for instant obedience either in ordinary routine or emergency.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent.)

The White Star Line and Southampton.

THE sensation of the last few weeks in the shipping world has undoubtedly been the announcement that the Wednesday service of the White Star Line is to be transferred from Liverpool to Southampton, when the new leviathan *Adriatic* comes on to the station. The reason for the move is the desire on the part of the management to obtain a share of the continental passenger traffic, and for that reason the steamers will call at Cherbourg both outwards and homewards and on the westward trips will also visit Queenstown for the British mails. The combine will thus have both a Wednesday and a Saturday sailing from Southampton towards New York. Three weeks out of four they will take the British mails in their Wednesday steamers, but I presume on the fourth, the Nord Deutchser Lloyd will still have the bags, as there is no indication that the *Adriatic* will be faster than the *Baltic*, *Cedric*, or *Celtic*, and these ships have not usually been entrusted with the Post Office consignments. Liverpool will not be so hardly hit over the departure of these ships as some persons are apt to imagine.

I give the tonnage of certain ships of the fleet:—

NAME.	NETT.	GROSS.
Baltic	15,295	23,876
Majestic	4,443	10,147
Oceanic	6,917	17,274
Georgic	6,570	10,077

The figures in the case of the *Adriatic* will probably be about 1,000 tons greater than those of the *Baltic*. Remembering that it is nett tonnage on which dues are assessed, it will be seen that, as payers of dues, the *Majestic* and *Teutonic* are far less valuable to the Dock Board than such a vessel as the cargo steamer *Georgic*, of which the man in the street has probably never heard. Even the great *Oceanic* in this relation is comparable with the cargo ship named. The *Adriatic* will, of course, have a big nett register. But, whilst she goes to Southampton, Liverpool is to retain the three sisters, *Baltic*, *Cedric* and *Celtic*, all big carriers. These ships, in conjunction with the 15,000 ton *Arabic*, will maintain a new Thursday service from the Mersey, and doubtless this will be as popular in the future as the Friday service has been in the past. The blow to Liverpool is far more serious in prestige than in pocket, though it is disquieting to those interested in the port on the Mersey as an indication of the probable trend of future events.

Southampton, having no manufacturing centres behind it and no dense population nearer than London, it may be wondered what will be found to fill the capacious holds of the *Oceanic* and *Adriatic*. Had London not been so dead to what was proceeding in other ports, she might have received these ships after they had discharged their passengers and mails at Channel ports. But the *Adriatic* is, of course, far beyond Thames limits.

Trinity House

is a most respectable and interesting survival. It is an adaptation of a mediæval corporation to the use of modern requirements. No one who reveres what is old can fail to wish that it may long be spared. Yet it would seem that its present managers are bent on committing *hari kari*. Certain sections of the public have long had designs against the Corporation, and the recent astounding action of the Elder Brethren in regard to Submarine Bells will not fail to strengthen the hands of their opponents, whilst making their defence difficult to their friends.

The submarine bell has—everywhere except within the jurisdiction of the Trinity House—passed the experimental stage. The ships of the White Star and Cunard Lines have found its advantages in making the port of Liverpool, since one has been installed on the North West Lightship, at the entrance to the River Mersey. Off the American coasts several installations have been made, and the United States Government has not been slow to acknowledge the safeguard which it provides to the navigator. The great German liners have found it useful off Cherbourg and in their home waters, whilst the British Admiralty has been satisfied with the trials it recently made of the appliance aboard the armoured

cruiser *Antrim*. Trinity House, however, for some reason best known to itself, has set its face against it. The story would be incredible if it were not admitted. The Zeeland Steamship Company, which carries a hundred thousand passengers a year between the Thames and the port of Flushing, has determined to fit its mail steamer ships with receiving apparatus, and has obtained the promise of the Dutch Government to have the needful bell installations fitted at points likely to be useful to those who have charge of this line of steamers. To complete the work of safety, the managers of the Zeeland Company applied to Trinity House asking them to fit three of their lightships with these bells. To this request came a refusal based on the ground that two of the ships named had nothing but manual power. When pressed to fit the third they again refused, even when the Company offered, not only to bear the charges for installation, but also to pay for the cost of working. They tried to explain their refusal on the ground that the Shipowners' Advisory Committee had objected to the system. But it has since appeared that this is not quite the fact. Trinity House was desirous of spending a thousand pounds on experimenting with these bells. The shipowners very naturally objected to that. The stage of experiment is long passed. The invention is of recognised utility and accepted by every up-to-date authority. The Elder Brethren might as well have proposed to expend a thousand pounds in testing the accuracy of Sir Isaac Newton's conclusions regarding gravity as to experiment with this appliance, though doubtless the gravity experiments would not be so excellent an occasion for water pic-nics for the Elder Brethren and their friends. As they were not allowed to experiment, the authorities in pique refused to recognise the appliance at all.

A New Shipping Company

has issued its prospectus. It is called the Egpytian Mail Steamship Company, and has a capital of some £660,000 sterling. Its object is to build two thirteen thousand ton turbine steamers for the service between Marseilles and Alexandria. It is intended that they shall make the crossing in about seventy hours. The vessels will be designed on the lines of the best modern Atlantic passenger ships and will offer every luxury to the traveller. The prospectus contains an extract from a recent report by Lord Cromer, from which the immense expansion of the passenger trade to Egypt during recent years is sufficiently apparent. The German steamship companies, with their usual readiness to enter into new trades, have already begun to cater for the tourist to the land of the Sphinx, as is evidenced by the purchase of the favourite Union-Castle liner *Scot* for this trade by the Hamburg American line. Doubtless, the new line, which offers special facilities to British and French travellers, will still further stimulate the movement. The directorate of the new company is especially strong, Lord Armstrong being the chairman. Even before the prospectus came before the public, sufficient support was assured from private sources to warrant the directors in proceeding to allotment.

The Collision at Cherbourg

was found, as noted in the last issue, to be solely the fault of the *Kaiser Wilhelm der Grosse*. I had proposed to make some remarks on the judgment of the British Court of Admiralty in this case, but I must defer doing so, as the Nord Deutchser Lloyd Company has entered an appeal in the matter. I may say, however, that the *Kaiser* is back at work again after extensive repairs in a German dock.

The Earthquake at Kingston

has not, up to the time of writing, been reported to have had very serious results for shipping, though it is quite possible that, owing to the shallowing of the water off the island of Jamaica, we may hear of further strandings of vessels, which being at sea when the catastrophe occurred, have had no warning of the altered conditions. The Hamburg American Company is so far the only line to have had any serious accident in this connection, their *Prinz Waldemar*, a single screw vessel of some five years old, having gone ashore at Plum Point, not far from the spot where the Company's excursion steamer *Princezzin Victoria Luise* still lies. The *Prinz Waldemar* is not a very important ship, being of well under five thousand tons gross register. She was built at Hamburg and has quadruple expansion engines.

The Direct Line's fine twin-screw liner *Port Kingston* was caught without steam at Kingston and was nearly in serious trouble, being lifted on to the mud and thus unable to get away from the burning wharfs. Her crew, however, managed to keep the fire from her, whilst the engineers forced the steam, and eventually drove her into a place of safety. Meanwhile, Sir Alfred Jones, who happened to be with a party of guests in the Colony, was on the spot, not only to look after the many interests with which he is connected, but also to render such aid as a man of his ideas and versatility could offer to the authorities.

A Salvage Job.

Some little interest attaches to the work which is proceeding on the wreck of the steamship *Highland Fling*, of the Nelson Line. This vessel went ashore in Kennack Bay, near the Lizard, at the beginning of January. Her forepart was firmly fixed on the rocks. A salvage contract was made by those interested in her with the Western Marine Salvage Co., who promptly began jettisoning the cement, which formed her cargo. Then, finding the situation "desperate," they proceeded to attempt a repetition of the *Milwaukee* experiment. That is to say, they determined to sacrifice the bow-end of the ship and to attempt the salvage of the remainder. Accordingly they set to work to cut the vessel asunder. The weather was by no means favourable for their task and they were some days in accomplishing it. When at last it was completed, it was found that the after part would not float, being evidently damaged by the severe buffeting which the ship had sustained whilst fixed on the rocks. It is somewhat doubtful whether, even if successful, it is worth while to undertake such a business in the case of a vessel which was built as long ago as the year 1890, though it should not be forgotten that the *Highland Fling* is fitted with refrigerating machinery and otherwise a first-class ship. At all events, the main part of the vessel is now in safety at Falmouth, whilst the bow end has gone to pieces.

Messrs. Furness, Withy & Co. accomplished a difficult job in floating the six thousand ton liner *Awa Maru*, which went ashore on the West Scar Rocks, off the Yorkshire coast, on the night of the 27th December. The vessel had dragged ashore in a furious gale after vainly trying to anchor, and was well up on the rocks. But on the 13th January, she was safely floated and taken into the Tyne for repairs. If I am not very much mistaken, this vessel was the first big liner which the Nippon Yusen Kasisha had constructed for their fleet in a Japanese yard. She was not quite eight years old.

The Newhaven and Dieppe Route.

A bill is now before the French Parliament which shall enable the State to purchase the Western Railway of France, and add it to the general system of State railways in that country. Such purchase, if carried through, would involve also the nationalization of the line of steamers which ply from Dieppe to Newhaven. The service between those ports is maintained, as my readers know, by an excellent fleet of steamers, comprising some of the earliest and best Channel turbine vessels. They are owned partly by the Chemin de Fer de l'Ouest and partly by the London, Brighton and South Coast Railway. The Shipowners' Association of France has, however, lodged a strong protest against the passing of the proposed bill into law. One of the points they make against the bill is that the working of a purely commercial line, like that from Newhaven, would be an entirely new departure for any State. Governments have hitherto confined their activities in this direction to the subsidizing of lines which they wished to encourage, or at the most to working mail services, such as that from Ostend, which is, of course, a branch of the Belgian State Railway.

Messrs. William Petersen & Co.

are a wonderfully energetic firm. The senior partner in the present combination was responsible for the organization of the Company which so nearly secured the contract for the 20-knot mail service to Canada a few years ago. Since then, he has had other ventures in the Canadian trade, and now he is starting the New York and Continental Line, which is to ply from the Empire City to Hamburg and Rotterdam. The Erie Line has made favourable arrangements with the new venture, whereby they will have excellent docking facilities at New York, and will also be able to grant through

bills of lading for the carriage of goods shipped by their steamers over the Erie and other connected systems. The attack of the new line seems to be chiefly directed against the Hamburg American Company, whose interests in the New York trade are so large. That company is, therefore, preparing to meet the foe, and is organizing a new cargo service across the Altantic, under the management of the Reederei Syndicate, which of course, was constituted with a view of meeting such interference with the trade of the established Hamburg lines. The first sailings of the new Syndicate will be made on the 30th January and will at present be continued by fortnightly despatches.

The P. & O. Company

is at the moment at the end of its building programme. The *Nore*, the last of the four "N's" is now completing at Messrs. Caird's yard, and when she is delivered, the great Leadenhall Street Company will have no vessel under construction, or even on order. It is said that it is thirteen years since such a state of quiet prevailed in the fleet. In the period named, no less than eight millions sterling has been spent on new construction by the Board of Directors, this money procuring for the Company upwards of 300,000 tons of shipping of various types and classes. A large proportion of the huge sum so disbursed has been spent with the Greenock firm of Messrs. Caird & Co.

The Nippon Yusen Kaisha

continues to do well. Its half-yearly report has recently been issued and, whilst it pays a dividend which brings its distribution for the whole year up to 10 per cent. on the ordinary share capital, it is able to add a special bonus of two per cent. to its fortunate shareholders.

AN IMPROVED BOILER-TUBE CLEANER.

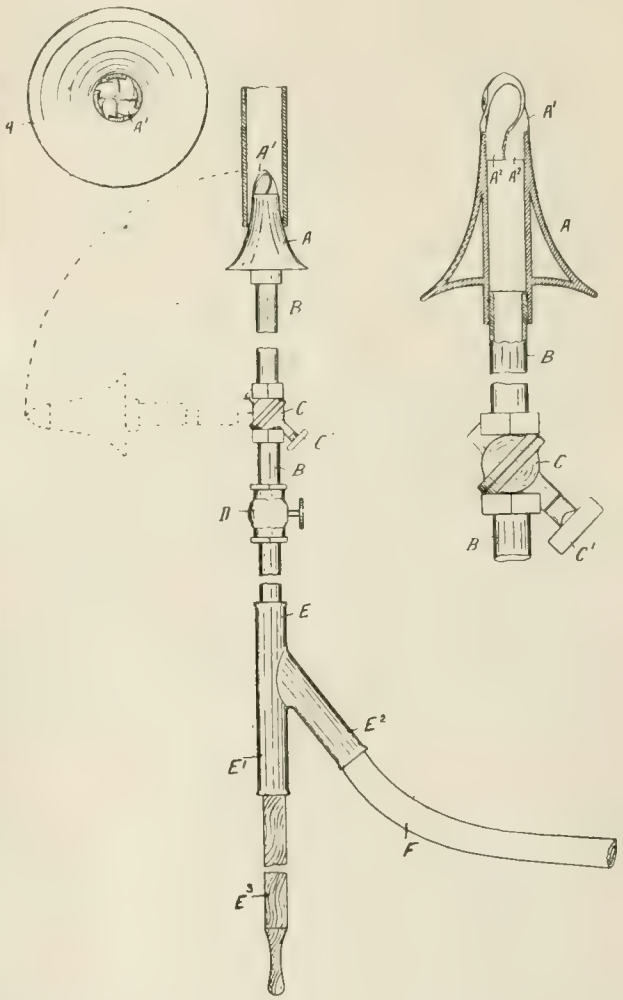
WE have pleasure in bringing before our readers' notice the advantages to be derived by the use of an apparatus known as Decent's Spiral Steam Tube Cleaner, and the adjoining illustrations explain the purpose for which it was designed:—

A is a bell-shaped centering piece provided for the purpose of centering the nozzle within the tube, and to enable the one apparatus to fit different tubes of various diameters. A^1 is a nozzle which may be integral with the said centering piece or may be screwed therein, as shown. If the latter, it is essential that the thread of the screw should be in the direction opposite to that of the spiral passages through the nozzle, as otherwise the pressure of the steam would have a tendency to unscrew the nozzle. The spiral passages A^2, A^2 may extend to any desired length within the steam pipe, and may project from half an inch to an inch and a half beyond it.

B is a rigid metal steam pipe, which preferably extends right through the bell-shaped centering piece. C is a swivel lock joint. C^1 is a locking thumb screw.

The function of this joint is to permit of the nozzle being conveniently inserted in tubes which without it would be difficult or impossible to reach. D is a valve for controlling the steam supply. E is a bifurcated joint, the legs E^1 and E^2 respectively carry the operating handle, and connect with the flexible steam pipe. E^3 is an operating handle, preferably of wood, and F is a flexible steam pipe, connecting with the steam supply.

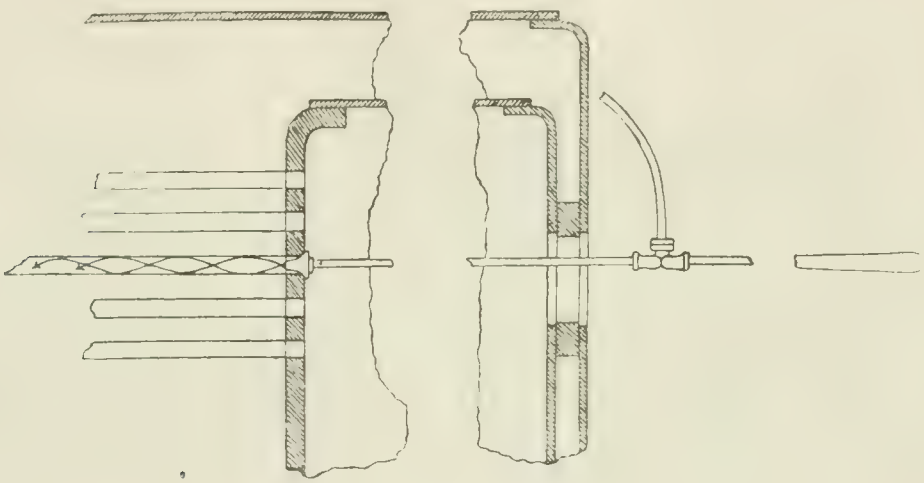
The *modus operandi* for cleaning the tubes of either a locomotive, steamboat, or stationary boiler is so simple that when once attached (which can be done for a few shillings in many instances) a boy can direct the work without any stoppage of machinery, and the fuel and time saved is of considerable value. Three to five seconds, we are informed, or 12 to 20 tubes a minute, is ample for each tube, so that it will be seen



that a railway engine with 270 or more tubes can now be cleaned in ten or fifteen minutes, as against three to three and a half hours by the old method; and what applies to the railways equally applies to the shipping companies and other users of steam, in proportion to the extent they have it in use. The patentee informs us that whilst the patent was primarily designed for the purpose of cleaning ordinary cylindrical soot boilers, it provides for any purpose where

disruption and a scattering action can be obtained with fluids, steam, or compressed air, such as extinction of fire and washing out sand-banks containing alluvial deposits. It is also effective in cleaning small drains and other pipes that have become foul. Mr. Decent, having perfected his plans with regard to the soot boilers, is now turning his attention to the water-tube boilers, and numerous certificates show with what results. He has also another very important branch in hand in the condensers, which he has every reason to believe will prove of inestimable value, and, when known, will be universally adopted by all shipping and refrigerating companies carrying condensers.

The invention has been taken up more or less by the majority of the Government Railways throughout the States, by shipping companies, leading Government departments, dredging companies, and manufacturers with repeat orders extending over a period of six years, so that it is evident it has come to stay, and that the Spiral Steam Tube Cleaner Co. has a good future before it. Messrs. Silley, Weir & Co., of 155, Fenchurch Street, London, are acting as agents for this Company, and in their hands we feel sure will meet with further success.



An improved Boiler-tube Cleaner.

A Social At Home with dancing was held on Monday night, December 31st, at the premises of the Institute of Marine Engineers, 58, Romford Road, Stratford. The arrangements were eminently successful in giving enjoyment to about 100 visitors, consisting chiefly of Junior Engineers and lady friends. During the evening several songs, which called forth hearty applause, were sung by Mrs. McInnes, Miss Weir and Messrs. Reid and Camelleri, but the dancing was evidently considered the main portion of the entertainment. At midnight the party joined hands and united in singing Auld Lang Syne. The invitations were issued by Messrs. Hawthorn and Lang (joint conveners of the Junior Section), who, assisted by Mrs. Hawthorn, Mrs. Lang and Mrs. Jas. Adamson, provided the refreshments, and arranged the programme.

ARTHUR'S BEAM-BENDING ROLLS.

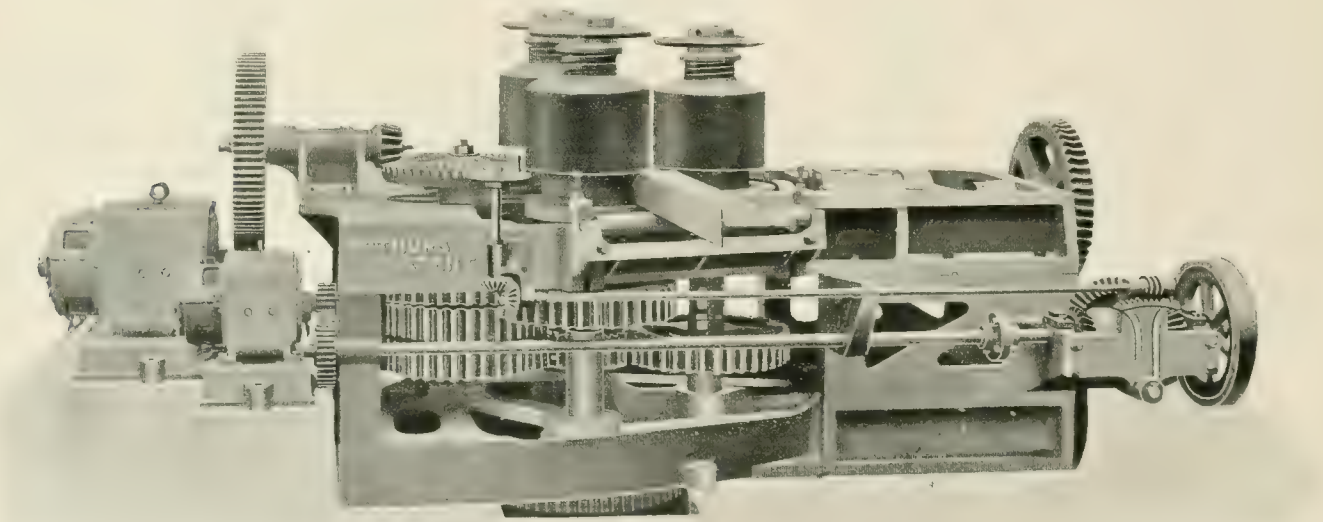
BEAM and other bar-bending and straightening machines, hitherto used in shipyards, have mostly been of the reciprocating push or squeezing description, to which disadvantages more or less serious attach, but for the better part of eighteen months a bar-straightening and beam-bending machine, designed to overtake these important operations on all sections of steel or iron ordinarily used in ship construction by means of rollers, instead of pushing arms, has been in use in the works of William Beardmore & Co., Dalmuir, accomplishing highly satisfactory work in connection with the heaviest, as well as the lightest, class of material involved in both naval and mercantile ships.

This is Arthur's Patented Roller-Bending Machine, of which we herewith give an illustration—taken from the machine installed in the Beardmore works. The inventor is Mr. Nicol S. Arthur, Glasgow, whose name is well known in connection with the frame-bevelling machine which is so extensively in use in the shipyards of this country and abroad. The advantages claimed for the new type of bending machine are the fairness with which bending and straightening is effected, the expedition and ease with which the work is accomplished, and the greater range of curvature possible by the machine without the need of any "furnacing" of the material being operated on.

The reciprocating squeezer machines at present mostly in use do not set the bars to a fair curve, and fail to prevent the edges of the bars from buckling and twisting, and they must operate on each flange of the bar separately. The work they can undertake is limited to bars bent to large radii, such as ships' deck

beams, bars which must be curved to smaller radii requiring to be heated in a furnace. The reciprocating motion of these machines entails much loss of time between the squeezes, while the bars also require to be pushed through the machine by manual labour, and they receive an impression only at intervals, which causes flat parts—more or less unsightly—in the curve. Moreover the edge of the bar is apt to be indented with the sharp face of the squeezer. In the Arthur bender, on the other hand, the rollers produce a fair curve, as every inch of the bar is subject to the same pressure.

Our illustration herewith, shows the machine in the Beardmore establishment, operating upon a portion of a heavy beam. It will be gathered that it consists of a strong entablature, having three projecting vertical cast-steel rollers, carried on strong forged steel spindles. The work is bent between the two back rollers, and the front and bending roller. The latter has fixed bearings and the two back rollers have a radial adjustment to suit the various depths of angles, beams, etc., being treated. The rollers have bottom flanges slightly above the table level, upon which are fitted cast steel sleeves, vertically adjustable by screws and hand wheels, by which they can be lowered close to the roller flanges or raised to form recesses for receiving any given thickness of beam flange. The action which adjusts the back rollers for deeper beams, etc., also increases the distance between the centres of these rollers in the correct proportion for the depth of section being treated. By the arrangement of gearing all the rollers are concurrently driven, which ensures an absolute feed. The two back rollers, with their spindles, are carried in quadrant links made of steel, with steel tension links for their adjustment. This is effected by square-threaded screw carrying a nut block, operated by hand wheel or by motor, at the end of the machine, the back rollers being quickly adjusted to their work whilst running and bending. The roller spindles run in broad gun-metal bearings, and the other spindles are also fitted with gun-metal bushes, adjustable where practicable. Two horizontal rollers, one on each side of the machine, and adjustable vertically, are provided for carrying the work and controlling the vertical flange of the bar being operated upon. To prevent the bar twisting, buckling, or travelling out of line, the edges are made to run in a groove, formed by the space already described between the sleeve and the bottom lip of the rollers. These sleeves can also be used to grip the edge of the lighter bars, so as further to ensure proper feed through the machine.



Arthur's Beam-Bending Rolls.

These machines can be supplied with electric motor, coupled direct for driving, or they may be fitted with loose and fast pulleys for open and cross belts, with belt gear for stopping, starting, or reversing, and with hand wheels for adjusting bending rollers. With one of the machines a ship's frame was bent to the mid-ship bilge curve, and the requisite camber was given to heavy deck beams of bulb-angle and bulb-tee section, the flanges being perfectly free from twist or buckling. In the latest machines, which are made by Messrs. Smith Bros. & Co., Kinning Park, Glasgow, all wheel and other gearing is below the level of the table-top, thus leaving a completely clear surface. The machines are made in two sizes, *viz.*, one adapted to take in work up to 8 ins. deep, and one suited to deal with work up to 13 in. deep.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondents.)

Portsmouth Dockyard.

IT is pleasing to note that a communication has been received by the Admiral Superintendent from the Lords of the Admiralty, stating that they recognise with much pleasure that the exceptionally early completion of the *Dreadnought* has been achieved by the special efforts which were made throughout the period of her construction by the staff of the dockyard, and they direct that their Lordships' cordial appreciation of the zeal which has led to this most satisfactory result be expressed to all concerned. The ship was finally inspected by the Admiral Superintendent and officially handed over by the dockyard authorities on completion on New Year's Day. On January 4th, she proceeded to Spithead, where she was inspected by Admiral Sir Archibald Douglas, and next day, she left for a special cruise, during which she will visit Vigo, Gibraltar and Trinidad. On the conclusion of the cruise at the end of March, she will proceed to Sheerness, where she will take up her duties as flag ship of the new Home Fleet. A fire broke out in the camp equipment stores at the Gun Wharf on the night of January 2nd, and completely destroyed the building, in which was a large quantity of tents and equipment. In addition to the fire brigades, all the ships in harbour sent assistance, and altogether about two thousand men assisted in the work of extinction, but it was over three hours before the flames were got under. Sir Archibald Douglas was present, and he subsequently issued a memorandum praising highly the work done by all engaged. No Admiralty property was burnt or injured. Nothing definite has been discovered to account for the fire, but it is believed to have been due to the overheating of a small stove in one of the upper floors. Rear Admiral Robinson, has, therefore, ordered an examination to be made of all such stoves, with a view to preventing similar outbreaks. It has also been suggested that the fire may have been due to spontaneous combustion, and this is considered by many to be the most likely origin. With the departure of the ships of the Atlantic Fleet, on January 14th, the harbour again presents its normal appearance. Sir William May's Flagship the *King Edward VII.*, did a good coaling performance before she left. Alongside the floating coal depot, she took in 1,060 tons in two hours and thirty-five minutes, an average of 363·4 tons an hour. The 12,000 ton floating coal depot is proving most useful, and we understand that a still larger one is to be constructed. Despite our new ship, the present prospect is not at all cheering. Hitherto, we have had one ship completing while another is building, but such is not the case at present. Work is somewhat slack, although the battleships, *Glory, Revenge* and *Prince George*, and the cruisers, *Terrible* and *Latona*, are undergoing refits. The *Prince George* is to be ready by February 6th, to rejoin the Channel Fleet. The ships of the Atlantic Fleet did not provide us with any work, for defects are now made good by the artificers of the fleet. Indeed, the ships are said to have been kept in such good order, that the captains and engineering staffs are fully satisfied with the new order of things. And perhaps it is better than allowing defects to accumulate until the vessels come into the dockyard hands. His Majesty's yacht, the *Victoria and Albert*, is undergoing an extensive overhaul, so as to be ready for the trip of the King and Queen to the Mediterranean during the Spring. The Admiralty have decided that a new lock, capable of taking ships of the *Dreadnought* class is to be built, the site chosen being where the coaling depot stands. The construction of the work is expected to be begun in a couple of months' time.

Sheerness Dockyard.

Although the Commander-in-Chief at the Nore has gone to Chatham, and the residential portion of Admiralty House is unoccupied, the telegraph and telephone offices still remain open. This state of things will continue until Rear Admiral Bridgeman arrives early in March to take up his duties as Commander-in-Chief of the new Home Fleet. The battleship *Dreadnought*, which is to be his flagship, is due here at the end of March on the conclusion of her cruise. The last official act of Admiral Sir Hugo Pearson was to issue a general memorandum, in which he bore testimony to the assistance rendered him by officers and men in the conduct of the King's service, and paid a tribute to them for the discipline that had been maintained during his three years' command. The departure of Admiral and Lady Pearson was made the occasion of an enthuiastic gathering at the station. The platforms were lined by officers and men of the Gunnery School, and the band of that establishment was also present. With the transfer of the Nore headquarters to Chatham, other changes have taken place. The late Lord Dalhousie's yacht *Hiawatha*, known for many years as the *Wildfire*, has been re-named the *Undine*, after a coastguard cruiser recently sold, and the sloop *Nymphe* has been re-named *Wildfire*, and she acts as parent ship of the tenders of the Gunnery School. The *Undine* arrived at Sheerness on January 15th, having on board Admiral Sir Gerard Noel, the Commander-in-Chief at the Nore, that being his first visit to this port since taking over the command, in consequence of a slight illness. The *Undine* was berthed alongside the Cornwallis Jetty, and was boarded by Captain Startin, the captain superintendent (who is now the senior officer at the port), the commanding officers of the vessels in port, and the principal officers of the yard, all of whom were presented to the new Commander-in-Chief. Our work has been lately with torpedo craft. The destroyers of the Second Flotilla have had their defects made good, with the exception of the *Seal* and *Sprightly*, and left on January 12th for Portland. On the voyage, the *Wear* came into collision with the steamship *Etna* (1,200 tons), off Beachy Head next night. The steamship put into Dover and the destroyer, although seriously damaged, proceeded to Portsmouth, where she was docked. The *Ness*, which went to the assistance of the *Wear*, was also damaged, but she accompanied her sister vessel to Portsmouth, and afterwards returned here for repair. The topedo gunboats *Hussar* and *Speedy* are having their defects made good, and the destroyers *Ranger* and *Lively* are also in hand. The sloop *Fantôme*, which is being converted into a surveying vessel for service on the Australian station is expected to be ready in a few weeks. The future of the port is just now attracting some attention, and many believe it will be more important as the headquarters of the Home Fleet than as the headquarters of the Nore Command. There is an impression that the Admiralty will prefer to develop a base that already exists rather than expend several millions on Rosyth, but nothing has transpired officially. It is certain that something must be done to make proper provision for docking the *Dreadnought* and her sister ships here. The best way to do this, in the opinion of those competent to judge is by the provision of floating docks, such as referred to last month.

Devonport Dockyard.

On New Year's Day, the first keel plate of the *Temeraire* was laid, the ceremony being performed by Lady Beaumont. No one was present except the officials, the ceremony, like everything else in connection with the building of the ship, being regarded as of a private character. Admiral Sir Lewis Beaumont, Vice-Admiral Barlow (the admiral superintendent) and Mrs. Barlow, Mr. Richards (constructive manager), and Mr. Cole (the constructor), were the chief spectators. A great deal of material was accumulated previously, and several large consignments have arrived during the month. Several pneumatic machines are to be sent from Pembroke for use in building the ship, they being urgently needed to push on the construction, and no funds will be available to buy any until the next financial year commences. The construction of the ship is to be proceeded with rapidly, and she will probably be launched in July or August. Keyham Extension Works no longer exist, for the 120 acres upon which the contractors have for the past eleven years been constructing basins, docks and jetties have now become part of the North Dockyard. There are, however, still over four hundred of the contractors' men engaged in completing the extension and in clearing up. The Prince and Princess of Wales will pay us a visit on February 20th for the purpose of formally opening the works. The Royal visitors will arrive at Millbay station, and proceed through Plymouth and Stonehouse to Admiralty House. The streets will be lined by the naval and military. They will afterwards proceed to the tidal basin and embark in the Commander-in-Chief's

yacht, the *Vivid*, which will steam into the enclosed basin. The yacht is now being prepared for the accommodation of the Royal party. The Mayor has received a communication that as the visit is for the sole purpose of opening the Extension Works, their Royal Highnesses do not see their way clear to undertaking functions which are not connected with that special object, and regret that they will be unable to receive an address on their arrival or to take luncheon at the Guildhall as had been proposed. We have had the unusual spectacle here of a white warship. It has been the practice to paint the ships serving on the East Indies Station white, the painting being done after the arrival of the ship on the station. The Hyacinth, however, which is to be the flagship of Commodore Sir George Warrender, the new chief of the squadron, has been painted white previous to leaving for the East Indies, and she looked quite a picture. She has now gone on to Chatham, where she will be commissioned on February 2nd. The net defence fitted to the Hibernia, which battleship has now joined the Atlantic Fleet, is of a new pattern. The nets are 28 feet in depth, thus protecting the ship's under water parts at the deepest draught and providing a resistance to Whitehead fire. Two electric searchlight projectors of 36 inches diameter were also mounted on special platforms.

Chatham Dockyard.

Our latest battleship, the *Africa*, left to join the Atlantic Fleet on January 8th. She hoisted the pennant about a couple of months previously, but the fitting for the fire control for her heavy guns was not fully completed when she was commissioned. The vessel is fitted to carry both coal and oil fuel, and the stowage of the latter presented some difficulty in consequence of leakage. The *Africa* will be the last battleship to be built here, unless the authorities alter their minds, and the longer the slips are unoccupied, the less likelihood there is of the yard being restored to its former position. The local authorities are not overlooking the question. The corporations of Rochester, Chatham and Gillingham recently appointed a Joint Industries Committee, which has gone fully into the reduction of the yard. They have again resolved to approach the Admiralty, and if it can be arranged a deputation will shortly wait on their Lordships. Much uncertainty exists as to the official intentions with regard to Chatham, and the result is that business is dull; indeed, some of our industries are almost crippled. If an assurance is given that the present strength of the yard is to be maintained, it will in some measure allay the apprehensions of those interested in the district's welfare. The number of men employed has been brought down to what it was previous to the South African War—during that time it was abnormal—and if constant work is found for those now employed, we shall be content. The question as to the provision of larger docks to accommodate the largest vessels of the Home Fleet is being discussed. An impression prevails that the dock which was last constructed is capable of taking the *Dreadnought*. The dock is large enough, but the entrance is too narrow to allow such a large vessel to enter. Then there is the question as to whether there is sufficient depth of water in the river. Many thousands of pounds have been spent in the past in keeping the channel clear of mud, but latterly, dredging operations have been conducted on a much smaller scale. Anyway, there is no reason why the authorities should not consider the advisability of spending some money on making Chatham an efficient base for the North Sea. One advantage we possess is that there is plenty of land available. The arrival of the battleship *Victorious* was very welcome, as repair work was getting slack; she will undergo an extensive refit before she commences her duties with the Home Fleet. The *Dominion* may also be expected in a few weeks from Bermuda, where she has been patched up. It is not expected that the vessel will be ready for sea in much less than six months, for there is reason to believe that she was considerably strained, in addition to the injuries to her bottom and sides. The cruiser *Cochrane*, which is now being completed at Govan has been allocated to this port for manning purposes, and she is to be commissioned here at the end of January, for service in the Home Fleet at the Nore.

Pembroke Dockyard.

The *Defence* is being pushed forward and almost all her armour is now in position, and the armour of most of her barbettes has been lifted on board. It was at first expected that she would have been launched in March, but May 10th has now been mentioned as the date—that will be two years and three months from the date of her laying down. We have been highly gratified at the receipt of an Admiralty minute regarding the saving effected in building the *Duke of Edinburgh*, although such a long time had elapsed since the ship was commissioned, that we feared the Admiralty did not intend to take any public notice of the saving. In their minute, their Lordships observe that they regard the saving as a creditable performance, and they desire an expression of their satisfaction to be conveyed to the officers and others who were concerned in the construction of the ship. The actual saving is not known, but it should be about £70,000, or, roughly speaking, rather more than six-and-a-half per cent. of the total cost, exclusive of guns. It is now expected that the Admiralty will make a statement of policy as to the yard, and put an end to our suspense. For over ten years, with the exception of the Royal Yacht, all the vessels built here have been cruisers, so it must be presumed that we are adapted for that class of work. It would, therefore, appear to be good policy to continue to build cruisers here and allot to the yard in the new programme a large cruiser instead of the mother ship or scout, as proposed. The cruiser *Warrior* has been allocated to Chatham as her manning port. She is now carrying out her steam trials and is due to return here on February 1st or 2nd, when her four 7·5 inch guns will be mounted to complete her equipment, after which she will carry out her armament trials. An order arrived about the middle of the month that a quantity of pneumatic machines, which were procured to replace others that were sent to Lundy Island for use during the salvage operations on the wrecked battleship *Montagu*, were to be sent to Devonport, for use in building their new battleship. A quantity of rivets is also to be sent there for use in building the same ship. It has been decided to erect a Marconi wireless telegraphic station at Angle, on the south-west bank of Milford Haven, near its entrance, and the work will be carried out by the Chief Constructor's department as soon as the necessary materials are available.

ELECTRICITY ON BOARD SHIP.

V.*

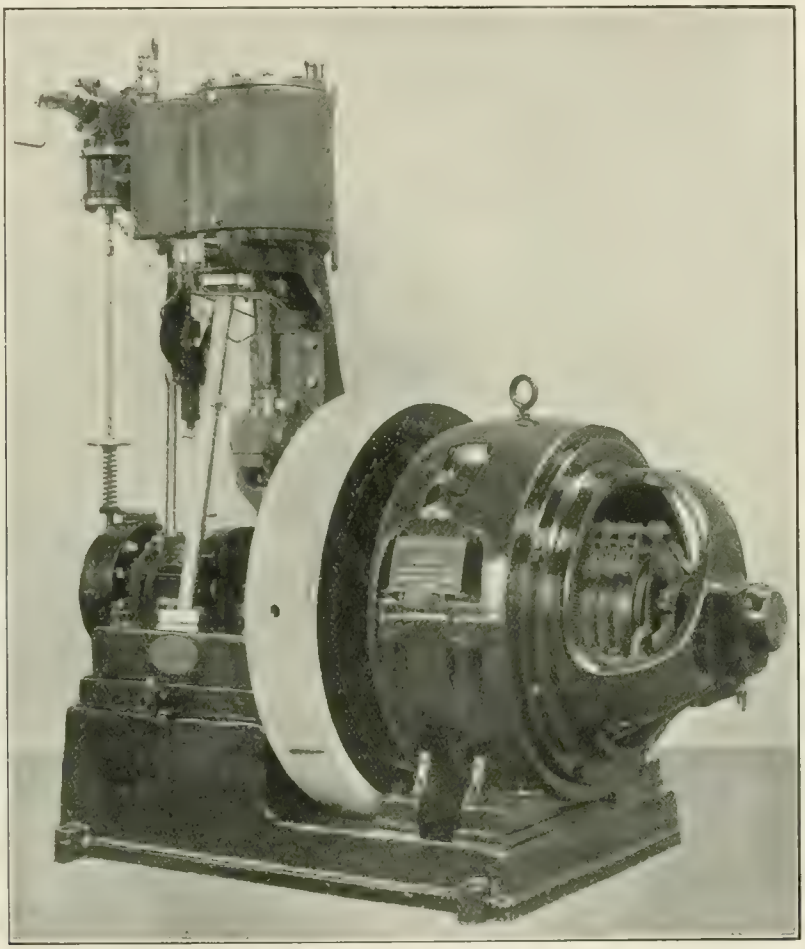
By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc. M.I.C.E., Etc.

Dynamos Suitable for Search Lights.

THE search light, though a very useful apparatus, in a great many cases is a very trying one for the generator. It burns with a long flaming arc, with very large carbons, and the length of the arc, even with careful regulation, is very apt to change suddenly, a sudden change of the length often bringing a considerable strain upon the generator and the engine. When the arc is burning with a certain length, and a certain current, if the feed mechanism suddenly comes into operation and shortens the arc considerably, the increased current strength brings a largely increased load upon the generator, and this reacts upon the engine driving it. It is now the common practice, and a very wise one, to furnish search lights with current from the main generating station, since the variations in the current taken by the arc will have less effect upon the large power employed for furnishing the whole of the lights and motors in the ship, than upon a separate engine and dynamo arranged for the purpose. In the early days of the electric light the search light was almost the only one employed on board ship, and it was run necessarily from its own dynamo, and its own separate engine, the dynamo having a pressure of 65 or 80 volts, and the engine being directly coupled to it. In the case of a small ship, or where the current required for lights and motors is small, so that the variation in the current taken by the arc would have a serious effect upon the pressure delivered by the generators furnishing light and power, it will be still wiser, where search lights are employed, to supply the search lamp from its own engine and dynamo. There are two difficulties that arise in connection with the

*For Articles I. to IV., see last four issues.

large variations that are apt to occur in the length of the arc of the search light. Every engineer is familiar with the trouble that arises when sudden very heavy variations of load are brought against an engine, particularly when the variations take the form of sudden heavy increases. The engine necessarily pulls up, to a certain extent, no matter how well it is governed, because it cannot otherwise obtain the necessary steam to deal with the increased load. In pulling up, however, it also lowers the pressure at which the current is being delivered, and this may have a serious effect upon the feed mechanism of the lamp. All arc lamps are arranged to feed by allowing one or both carbons to move, when the current passing through the arc has increased to a certain extent. Assuming an arc to be burning normally, supplied with current from its own dynamo, driven by its own engine, the arc tends to increase as it burns, the current passing thereby decreasing. Though the pressure slightly increases, the product of the pressure and current are gradually lessening, and the load upon the engine is gradually lessening. At some period, depending upon the regulation of the lamp, and the supply of the current, the feed mechanism is put in operation, and the carbons move towards each other, the load thereby being increased, because the product of the lowered pressure and the increased current are considerably in excess of that existing immediately before the feed took place. When the current for the search light is taken from the main generating station, in addition to bringing a strain upon the engine, which, as explained above, will be small if the search light itself only forms a small part of the total load of the strain, the increased current passing out from the station tends to lower the pressure at which all the cables taking current from the strain are supplied. When the generating station is a large one, and the search light forms a small part of it, the variation in the search light current makes only a very small variation in the distribution pressure, it buf the station is a small one, as in a small ship, or in a ship where only a few lights and motors are carried, the search light then forming a large portion of the load, the variation in the search light may have a serious effect upon the pressure, causing a nasty wink in the lights furnished from the station. When a separate engine and dynamo are employed for the search light, the dynamo should be a compound one, and its pressure may be from 65 to 100 volts. Some time ago the Admiralty adopted a standard pressure of 80 volts, mainly, the writer believes, because they found it a convenient pressure for their search lights, but for small search lights, provided the distance from the generator is not large, pressures of 65 volts should answer, and, on the other hand, a pressure of 100 or 110 volts should answer equally well, the surplus pressure being used up in an adjustable resistance, that will be found very useful in regulating the working of the arc itself. There is a certain amount of waste in the resistance, but it is not of great importance in this case. One caution should be given : where search lights are run from separate plant, as explained, both dynamo and engine should be well above their power.



Dynamo and Engine for use on Board Ship.

A shunt wound dynamo will answer very fairly for a search light, provided that it also is well above its power, but a series wound dynamo is not at all suitable, and will give trouble, because the variations in the lengths of the arc, and the consequent variations in the current passing, are reflected in the magnetism of the series wound dynamo, and give rise to largely increased variations in the load.

Dynamos Suitable for Incandescent Lighting.

The most suitable dynamo for supplying incandescent lamps for use on board ship, is the compound wound continuous current machine. In the early days of electric lighting on board ship, which corresponded with the early days of the incandescent lamp itself, and with the period prior to the development of the compound wound continuous current machine, alternating current machines were employed to a small extent. It was thought in those days that incandescent lamps worked better with alternating currents than with continuous currents, and, in addition, the alternating current machines of those days lent themselves much better to distribution, by the division of their currents into parallel circuits, than either the series or shunt wound machines that were the alternative. At the present time, however, the use of alternating currents appears to have completely gone out for board ship work. It is more than probable that the three phase alternating current will be used on board ship for power work later on, and the writer is intending to describe alternating current apparatus and three-phase machines, later in these articles. At the present time both for lighting and power the compound wound continuous current machine of 100 volts is the favourite. The compound machine, as explained in previous articles, maintains a constant pressure, either at its own terminals or at some convenient distributing point, with varying current strengths, within the limits of its own capacity, and the provision of current for incandescent lighting on board ships resolves itself into the provision of one or more compound wound generators, of sufficient power to furnish current for the whole of the lights that may be required.

The Arrangement of Dynamos in the Generating Station.

The use of electricity on board ship has become so large, that the arrangement of dynamos, engines, etc., employed may be fairly called a generating or central station, as it would be on shore. It consists of a number of compound wound generators, each driven by its own engine, which should be directly coupled to it, the number of engines and dynamos being ruled by the total amount of electricity required, and the size of each dynamo and engine being ruled by the minimum amount required at any time. The electric lighting and power service on board ship differs from that on shore, in the fact that large portions of the ship have to be lighted during the whole of the day, while on shore lights are only required for a few hours daily, and from the fact that the lighting required for a large portion of the ship is not much affected by the seasons. The engineer of an electric lighting station on shore is much troubled by the fact that the principal portion of his lights are only required for a few hours during the evening in winter, and hardly at all in summer. On board ship a large portion of the lights will be required, at all seasons, in all latitudes, during the whole 24 hours, and a substantial portion during the day. In any case, however, the minimum quantity of current required, at the pressure, or, say the minimum quantity of electricity, rules the size of the unit, as it is termed, in the generating station. It is usual to divide the generating station into a certain number of units, each unit consisting of a dynamo with its engine, and accessories, such as condensers, where separate condensers are employed. And the size of the units is ruled, as explained, by the minimum current. It is usual to run one or two units on light load, that is, when the quantity of electricity required is smallest, and to arrange that the remaining units can be brought into service quickly, and can be put out of service quickly, when increased current is required, or when the demand is reduced.

The arrangement of this will be explained in the next article.

Bell's Asbestos Co., Ltd., inform us that they have again been awarded the contract for the supply to the British Admiralty of their Asbestos Packings and Asbestos Millboard.

The Iron and Steel Institute.—The annual general meeting of the Iron and Steel Institute will be held, by kind permission, at the Institution of Civil Engineers, Great George Street, London, S.W., on Thursday and Friday, May 9th and 10th, 1907. The annual dinner will be held—under the presidency of Sir Hugh Bell, Bart.—in the Grand Hall of the Hotel Cecil, on Friday, May 10th.

THE VENICE PONTOON.

THE fact that a public floating dock capable of taking vessels up to about 400 feet in length is now available in Venice will be known to few shipowners, many of whom have in unpleasant memory the trouble, delay and expenses they were put to in getting the use of one of the dry docks at the Government Arsenal. The fact that this new pontoon, an illustration of which we give, can be had at rates more reasonable than those charged in most Mediterranean ports is well worth noting. We understand Mr. A. C. Holzapfel has recently visited Venice and arranged with the management of the dry dock there that it will in future be represented in Great Britain and other countries by Holzapfel's Compositions Company, Limited, of Newcastle-on-Tyne, etc., and its affiliated

Companies for the purpose of securing work. Messrs. Holzapel inform us that the cost of docking a vessel of 4,000 tons gross, cleaning botton, applying and supplying two coats of their International Composition and one coat of boottop, all complete, is £132, while for a vessel of 3,000 tons gross it is £112, which figures, we believe, compare very favourably with the cost of similar work at any other Mediterranean port. Messrs. Holzapfel have been authorised to quote complete prices for vessels of all sizes, and any work entrusted to them will be superintended by their Venice agent, Mr. Girolamo Marchini fu Alvise, San Marco, Ponte Pignoli, No. 763-64.

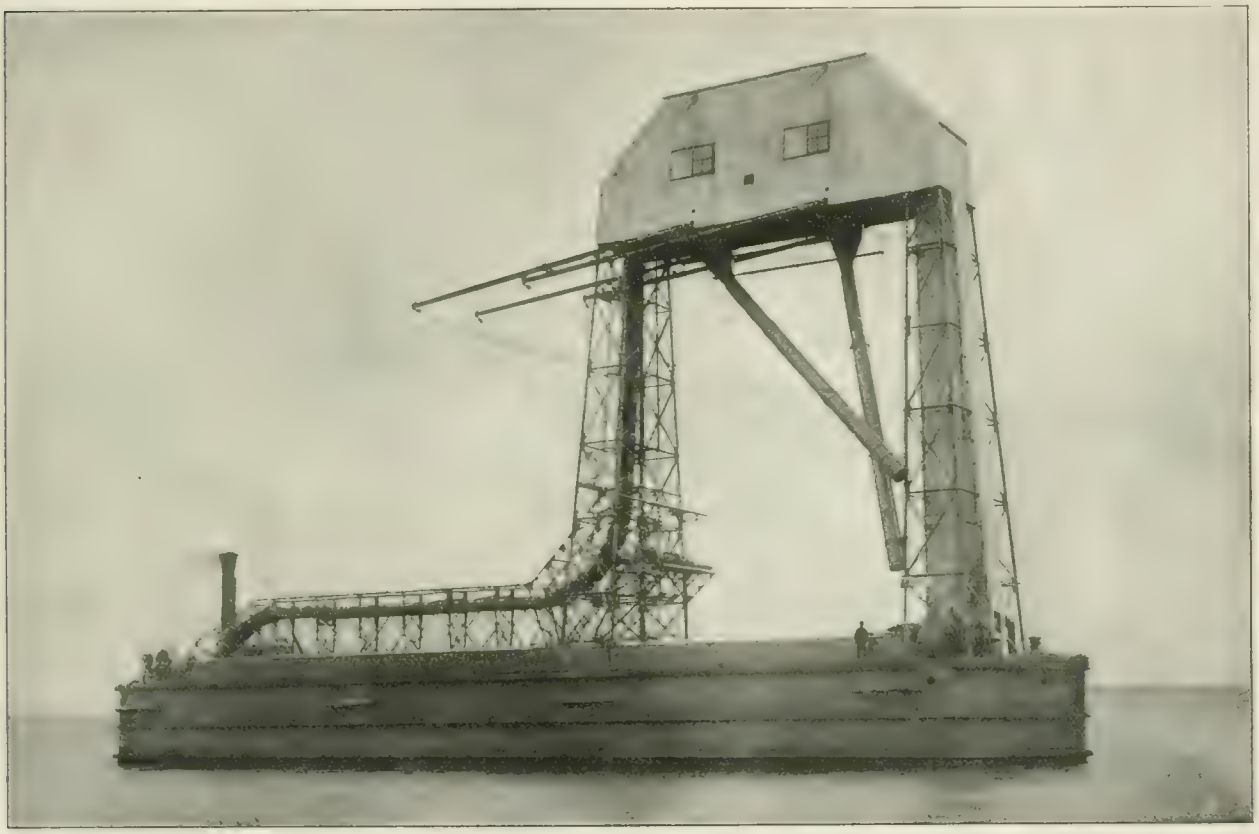
Flannery, Baggallay & Johnson.—In addition to their business in London and Liverpool, they have opened an office in Rotterdam (Boompjes 82), under the style Flannery and Gregson, so as better to meet their increased duties on the continent.

CLARKE'S AUTOMATIC COALING SYSTEM.

THE British Admiralty have for years past been anxiously looking for some system of rapidly coaling ships, which would obviate the great amount of hand labour generally involved, which is not only very irksome but is extremely expensive, and the question has forcibly presented itself to the Authorities whether the end justified the means. It is well known that the Admiralty have spent enormous sums of money in building coaling depots at various places, and steps have recently been taken to test by practical experiment whether the hand labour necessary between the depot and the ship bunkers can be eliminated or largely reduced.

To this end H.M.S's. *Vengeance* and *Cornwallis* paid a visit to the Mersey in November last, and were coaled in an exceedingly short time.

The test was to place from 900 to 1000 tons on board each vessel, and the *Vengeance* was coaled by means of Clarke's Automatic Barges, two of which were used, each containing 452 tons of coal. This barge is something like a floating grain elevator. The coal is just tipped into the barge in the ordinary way, the barge being provided with a false bottom, and between that and the keel bottom a space is arranged along which runs a continuous chain of buckets. There are a number of sliding doors in the false bottom, through which the coal drops into the buckets. The latter are carried perpendicularly up to a self-acting and self-registering weighing machine, and the coal, after being weighed in $\frac{1}{4}$ ton lots, is automatically tipped into adjustable chutes running down to the deck bunkers, hatches, or the side coaling ports of the ship as the case may be. The mechanism is ingenious, and really very simple, as apart from the engineer and crew, one man can work the barge in actual coaling operations, and he can instantly put the mechanism in motion, slow down, and otherwise regulate it, or stop coaling altogether.



Clarke's Automatic Coaling Barge.

In the test the two barges delivered the 904 tons of coal on board in $4\frac{3}{4}$ hours, but if a sufficient number of trimmers had been available this could have been easily reduced to $3\frac{1}{2}$ hours. We understand that on board the *Vengeance* the opinion was freely expressed that the barges represented the finest mechanical coaling appliance the officers and crew had ever seen, which appears to us to be most probable, having regard to the performance described.

In order to give our readers some idea of the form

of the appliance we illustrate in the adjoining diagram one of these barges.

The *Cornwallis* was coaled by a different method, part of the work of bunkering her to the extent of 1000 tons of coal was performed by the Rae Patent Elevator, known as the "Rae Grab"; the other portion being done by the ordinary methods of the port.

We shall look with interest for the further publication of the report, which will no doubt be made in due course by the naval experts of the Admiralty.

ELECTRICAL NOTES.

(*From our Own Correspondent.*)

USERS are generally becoming so familiar with electrical plants that one is apt to forget the simple rudiments of the subject, but many of the excellent volumes that are being issued by the press put forward in plain language the laws and rules by which electricians are guided. Perhaps it would be as well to note a few of these. For example, the pressure at the terminals of an incandescent lamp is usually either 110 or 220 volts, while the current for a pressure of 110 volts is about half ampere, the current through an arc lamp of 2,000 nominal candle power being about 10 amperes. The resistance of a copper wire ·01 inch in diameter and 10 feet long is almost exactly 1 ohm., while a copper wire ½ inch in diameter and a mile long has a resistance of ·2 ohm. and if the same wire were 10 miles long, it would have a resistance of 2 ohms., the resistance being proportional to the length, but if the same wire were one-half the diameter, it would have four times the resistance, which is inversely proportioned to the square of the diameter, all of which tends to show the care necessary in laying out a plant in order that the wires may not be too small, or, on the other hand, too large. If the former, a large portion of the dynamo energy is wasted in heat and yet, if too large, there is a loss on the metal itself. The length of the wire employed is also seen to be an important feature, and therefore great care is needful in the distribution of the leads. There should also be an equality of pressure at the lamps, as, if an efficient lamp receives more pressure than that for which it was designed, the effect is to give a short life to it, and if again wiring is small, so that turning off a number of the lamps causes the pressure to increase at the remaining ones by several volts, the most efficient lamps suffer in renewals.

A report upon a canal worked electrically in France presents an interesting study. The barges employed on the system the Canal D'Aire et de la Deule, at Douai, are 117 feet long, with a draught when loaded of 5 feet 10 inches and a beam of 16 feet and carry 290 tons. The canal has an average width of 63 feet and a depth of 7 feet. With such a high ratio of section of barge to canal the tractive effort per ton required to attain a certain speed is high. While steam and horses are both employed for draught, 90 per cent. of the whole traffic uses electricity. For this purpose, locomotives are employed, and to obtain adhesion on the rails, weights are built in the floor of the cab. When towing, a current of about 20 amperes is taken at a pressure of 800 volts. The tractors are reversible, the practice being on a single line to exchange barges and reverse direction when meeting. Current is collected from overhead wires by flexible cable, while the return circuit is through the track. The barges are fitted with a towing mast, standing 30 feet above the level of the deck, the mast being capable of being raised and lowered at will by the barge master. A peculiar necessity of this means of towing is that the rail nearest the bank has to be 1½ inches above the level of the other, so that when towing starts, there is no liability of the locomotive careening over into the canal. The drawback of steam tugs is the disturbance of the screws on the canal banks.

In the recently formulated radio-telegraphic convention and service regulations, provision is made for a wave length of 600 metres for coast stations and 300 metres for ships. Ship stations have to be licensed by the country whose flag the ship carries. These stations must use a syntonised system, working with power not exceeding 1 k.w. at not less than twelve words per minute and must carry a certificated telegraphist bound to secrecy. The order of precedence for telegrams is: (1) messages to or from ships in distress; (2) government telegrams; (3) service telegrams; (4) private telegrams. There are in addition regulations as to the calling and responding of wireless stations, charges, transmission and the ordinary minutiæ as applied to a telegraph service.

The new battleship *Hibernia* has a good many features of electrical interest. There are appliances for the rapid elevation and training of heavy guns, which are discharged by motor generators in place of electric batteries in the sister ships. Electric motors are indeed employed in this vesse to a greater extent than in any British warship, except the *Dreadnought*, over 80 being installed. The purposes for which these motors are used cover everything in the way of power, with the exception of the main and the principal auxiliary machinery. They are used in the bakery and cooking ranges, the searchlights include two of improved design, with 36 inch diameter mirrors, fitted with projectors, controlled by electricity, while the Whitehead equipment, controlled in the same way, is capable of discharging 18 inch torpedoes at 4,000 yards range.

An interesting exhibit at the recent Physical Society's exhibition of apparatus was a chronograph for recording variations of speed of engines. A drum covered with smoked paper is coupled to the engine shaft through two universal joints of a special design. A tuning fork gives a helical trace on the drum, mounted on a carriage, guided to move axially, the effect being that a divided circle is engraved on one end of the drum. The tuning fork is not provided with an electro magnet to keep it in constant vibration, but will vibrate sufficiently long to give clear indications over the greater part of the 24 revolutions, which carry it from end to end of the drum. The position of the tuning fork can be set by a screw adjustment, magnifying glasses being provided to facilitate this, and also over the divided circle of the drum. It is possible to uncouple the drum from the engine shaft by removing three screws from the coupling, and means are provided for a slow speed adjustment for setting the drum. The makers are the Cambridge Scientific Instrument Co.

JAMES WATT ANNIVERSARY.

UNDER the auspices of the Institution of Engineers and Shipbuilders in Scotland, the James Watt anniversary dinner was held, in the Grosvenor Restaurant, Glasgow, on the 18th January. Close on 400 were present and Mr. James Gilchrist, the president of the Institution, occupied the chair. A congratulatory message cabled from Japan was read by Vice-Admiral Engineer Miyabara, president of the Engineering Society at Tokio. In the course of the reply sent to the message, the hope was expressed that a cordial friendship might always exist between the engineers of Japan and Britain, a friendship based on truths and characteristics which stamped "Watt" a most excellent and amiable man, and one who "never failed to put all impostures out of countenance."

In proposing the toast of "the Imperial Forces," Lord Inverclyde expressed the hope that the day was long distant when the strength and the number and cost of the army and navy would be made a political party question. The shipbuilding programme, according to all accounts, was not being enlarged, which he thought was false economy. They were told the navy of this country was equal to the navies of any other two countries. He believed that was so—on paper—but they who had a knowledge of these matters knew that there were times when the vessels required to be laid up for repairs. He should like to know if the British Fleet, after the recent manœuvres, was an efficient power

equal to any two fleets. The public had a right to know this. They were being misled. He did not think our fleet was as strong as we thought it was. War was a horrible thing, but he did not believe in peace conferences. If our fleet was stronger than the fleets of any *three* powers, that would be far more likely to make for peace than any arrangement for a reduction of armament. Rear-Admiral Bearcroft, replying on behalf of the navy, said they hoped and believed it was powerful enough to do whatever duties might be required of it. The last addition to the fleet, which had just started on her maiden cruise, was to be duplicated by three others of the same class, which outside of two years, they hoped would make one homogeneous squadron of six ships of that class, a class which had entirely revolutionized the ship-building, the arrangements and the fittings of men-of-war. And although it would be more assuring, perhaps, to many, and certainly to the greater number of his audience that evening, if more ships had to be laid down, it was worthy of consideration that in view of the enormous cost of the ships of the present day and the extraordinary rapidity with which improvements were effected, it was perhaps almost advisable to hold our hands until further experiments had been made with those very newest ships, and that with fairness to the British taxpayer who had to foot the bill.

"Engineering and Shipbuilding Industries" was proposed by Lord Kingsburgh, who, in the course of an interesting speech said that when his father was a boy, nothing bigger than a fishing smack could get further than Port Glasgow on the Clyde and when his father and his brother were coming from Skye to school in Glasgow, they spent seven days between the Kyles of Bute and Greenock owing to a persistent gale from the east. They were just on the point of absolute starvation when the wind abated, and they succeeded in getting to school. What a change had taken place since then! One of the greatest engineering works in the world had been the clearing of the Clyde to make it deep enough to bring the largest vessels up to the Broomielaw, and the keeping of it open so that they could get down again.

Lord Kelvin, who was enthusiastically received, proposed the toast of "The Second City of the Empire," and remarked that although the population of Glasgow had doubled in the past thirty-five years, the death-rate was just about the same as in 1870. Could there be a better illustration of how admirably the city had been managed? One great thing done for the public health was the bringing of water from Loch Katrine. He remembered that in 1832, Glasgow was recovering from a severe attack of cholera. There were other attacks of that disease, but after the introduction of the Loch Katrine water supply, Glasgow escaped practically untouched. Lord Kingsburgh had told them of the Clyde as a fishing stream. Perhaps there might be salmon again. The great work of purifying the Clyde had been going on, and they could conceive that notwithstanding the steamers navigating the river, the water might be so healthy that not only fish would live in it, but the inhabitants on both sides of its banks might thrive in increased healthfulness above even the present high proportion that has been attained. Lord Provost Bilsland, in acknowledging, congratulated the ship-building and engineering industries on their prosperous condition, and on being able to maintain the great reputation of Glasgow in the maritime world.

The toast of "The Institution of Engineers and Shipbuilders in Scotland" was given by Mr. Alex. Ure, Solicitor-General, who traced its history from its inception half a century ago. He stated that it started with the modest membership of 127, and now had the magnificent and astonishing membership of 1,600. If one were to ask what it was that had mainly contributed to the greatness of Glasgow and to the proud position which it now held among the cities of the world, the answer would be that it was due to the energy and the enterprise, the inventive genius, the courageous initiative and the dogged pluck of the engineers and shipbuilders of the city.

The Greenock Philosophical Society had arranged to mark the event by a lecture from Dr. Robert Caird on "James Watt's Contribution to the Advancement of Engineering." Unfortunately, owing to the state of his health, Dr. Caird had to start a short time ago for Egypt and his lecture has been postponed till the end of the season.

WILCOX'S SPUR PROPELLER.

MEANS of propulsion for vessels has always been a subject of research in which great interest has been taken ever since the invention of steam-propelled vessels, and in view of the special interest that at the present time attaches to this subject, we make no apology for putting our readers in the possession of information relative to the new form of high-speed propeller which has been invented by Mr. Wilcox, of London, and was spoken well of by many experts. The losses of both our present propellers, paddle and screw, are known to be excessive, and to recover the losses there must be a new method and application, which must be a novelty, and this is one.

It appears to us that by the aid of the adjoining diagrams no difficulty will be experienced in clearly understanding the descriptive matter relative to this subject. We shall, therefore, proceed to describe the apparatus and will then give some particulars in the inventor's own words as to the relative conditions between his new form of propeller and the ordinary form at present in use.

Fig. 1 is a longitudinal section with two vertical narrow chambers in the after run of the ship, one between the centre and side of the ship on each side, as shown in the transverse section A.B. in Fig. 2. The inside of the chamber will be seen in Fig. 1 by the removal of the side G from Fig. 2, the chamber commencing with a curve C upwards from F below the load water line until it arrives at the top, and continues its peripheral boundary line downwards until it joins the rise of floor in the run of the ship at D; the chamber is open at the bottom between D, E and F, each side of the chamber is flat in the vetrical direction. Inside of the chamber a propeller is placed on the paddlewheel principle, with the shaft about 3 or 4 feet above the load water line; each propeller has 8 blades on it, and they are always maintained in a truly vertical position around their circuit of travel.

When the ship is at rest the water in the chamber is at the same level that it is outside it, as air is admitted at the top; but when the ship begins to move forward, the water begins to depress its level and continues so, especially at the forward part of the chamber between H and D, and when high speed is attained by the ship the water surface gets as low as D; therefore, the blades of the propeller cannot reach the water until they are at the bottom and are leaving the chamber and entering deep water on their edge, with their sternward motion in full velocity, with their square flat faces acting against deep water in their travel astern, and they rise upwards towards the surface on their edge through the current of water rushing into the chamber from behind, as shown by the arrows, and having the water on their edge and lifting no water up except the thin film that sticks to their surface by adhesion; the blades doing actual propulsion straight astern from the time they enter the water until they leave it.

There are three influences at work in keeping the water as low as D at the front part of the chamber whilst the ship has speed on her; the first is gravity, the second is the friction of the water in the chamber travelling with some speed after the ship against the outside water which drags it out, and third, the rushing of the blades astern at high speed taking a large portion of the water with them from the mouth of the chamber below.

Thus, the lowering of the water in the front part of the chamber, as shown, permits the blades to descend into deep water free between H and D; and no pressure of the water can act on their forward faces, because they are descending under cover of the front face of the chamber.

All parts of this propeller, on entering or leaving the water, are pointed or feather edged, so that they cut into the water on entering it, and cut out of the water in leaving it, therefore, will produce neither concussion nor vibration. The propelling action is carried on in water coming from underneath the body of the ship, and as shown by the size of the ship in the drawings, the bottoms of the propellers are several feet above the keel, and they will be subject to the same condition proportionately in smaller ships.

It will be observed that this propeller always act on a small volume of dense, solid water and in no way interferes with the natural flow of the water after the ship, like the screw-propeller; besides, it is better protected against floating

wreckage than either the screw or side surface paddle wheels, because the Spur propeller will depress any floating obstruction below it without getting hold of it.

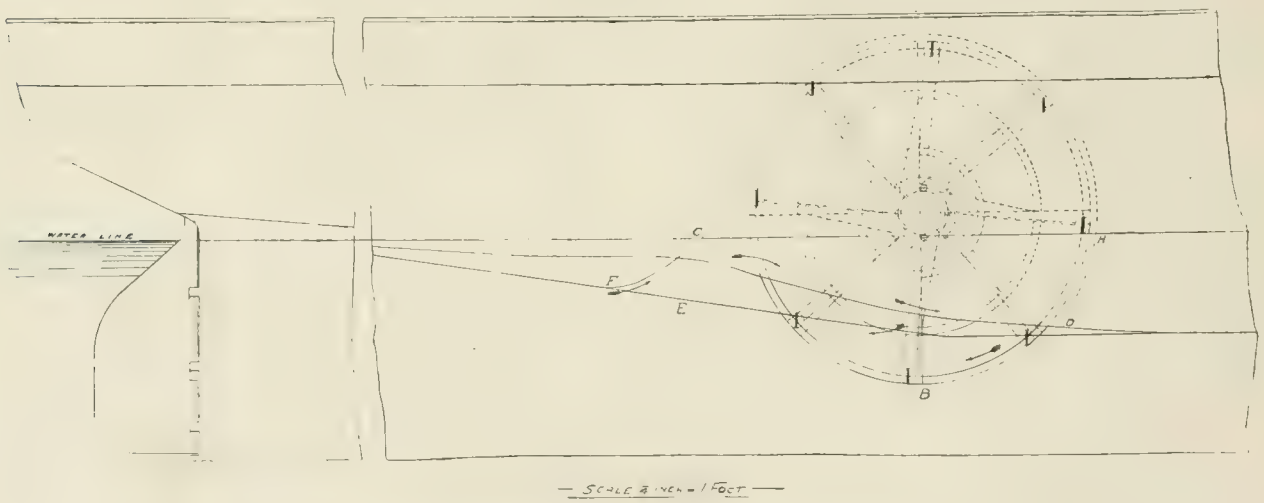
Fig. 3 is a view of the propeller showing the feathering gear and how the blades (floats) are held in a true vertical position in their entire circuit of travel. The centre portion in action is the propeller shaft; to the right on the horizontal line of the shaft's centre is a circle in a dotted line encircling the shaft, which represents a ring fixed either to the shaft bearing or to the sides of the chamber; on its periphery is a path for the roller wheels on the inner ends of the feathering rods to travel on; attached to each feathering rod is an outer stay ring to keep them in uniform position in travel. At the other side of the propeller there is exactly a similar arrangement, shown by the full black line roller path for the black centre's full line rollers to travel on. Now the other end of the feathering rod is attached to the crank on one side of the blade and at one end of it, the other crank on the other end, and other side of the blade is attached to a feathering rod on the other side of the propeller, and fixed to the outer stay ring that keeps the feathering rods in their uniform position on each side of the propeller, as before mentioned; therefore, there is a feathering rod on one side of the propeller with a roller wheel at the end of it and connected to the crank of a blade at the end of it; whilst the crank at the other side and the other end of the blade is connected to the feathering rod that has no roller wheel, but fixed to the outer uniform guide or stay ring, as already mentioned. It must be observed that the centre of the ring or roller path is some distance on the forward side of the propeller shaft: the radius of the roller wheels must likewise be the same distance, and the cranks on the blades must also be the same length. These parts, in whatever cases they may differ, must always be exactly equal in length for union of motion. It must be remembered that on each side of the propeller each alternate feathering rod has a roller wheel on it, and each alternate feathering rod is a fixed one at the outer stay ring. It will, therefore, be seen that the feathering method, on each side of the propeller are exact duplicates of each other, and that the eccentricity of the ring roller path is a forward one on one side of the propeller shaft, and on the other side of it the eccentricity is on the sternward side of the propeller shaft, as shown by the drawings. The feathering gear is a fixed one, that is to say, the crank pins in the blades are always a fixed distance from the centre of the roller path eccentric rings on each side, therefore, the blades never revolve. It is the bearings of the blade spindles of the blades that performs one revolution round the spindles for each revolution of the propeller in its reciprocating motion to and from the eccentrics' centres.

The other end of the feathering rods attached to the crank pins of the blades is shown in Figs. 3 and 4. Fig. 4 is a transverse view, in which it will be seen that the feathering rod is divided into two parts, one is the main part having half the hole or bearing for the crank pin, and having the bottom of it enlarged as far as the thick black angular line. The other part is partly curved at its bottom, which is stepped into the bottom part of first part, near the thick black angular line; and the second part having the other half hole or bearing in it for the crank pin; the two parts are then clamped together as shown, forming a durable and secure connection between the feathering rod and the crank pin of the blade that never moves, but is always held rigid in keeping the blades in a vertical position around their circle of travel.

Mr. Wilcox gives some interesting particulars as to the amount of thrust or push on the ship with the Spur Propeller, under equal conditions of size and horse-power, in comparison with that of the Screw Propeller.

Beaufoy proved by experiment that a plate, one square foot area wholly submerged, experienced a resistance of 112 lbs. drawn through the water at a speed of 600 ft. a minute, and that the resistance at other speeds varied as the square of the speeds. Froude proved the same fact (nearly) by experiment.

Having the data of the trial trip performance of the fast



WILCOX'S HIGH SPEED SPUR PROPELLER FOR STEAM SHIPS

Fig. 1.

cruiser *Drake* with her twin-screw propellers for comparison, for convenience we will turn her into a mercantile steamship to show the difference if she was propelled by the Spur Propeller.

The *Drake* is 500 ft. long, 71 ft. beam, 26 ft. draught and 14,100 tons displacement; highest speed 24·11 knots an hour, I.H.P. 31,409.

The theoretical thrust on the ship from her twin-screws was 164 tons, the half of that was the actual thrust or about 82 tons, and that is more than Froude allows in effective horse-power.

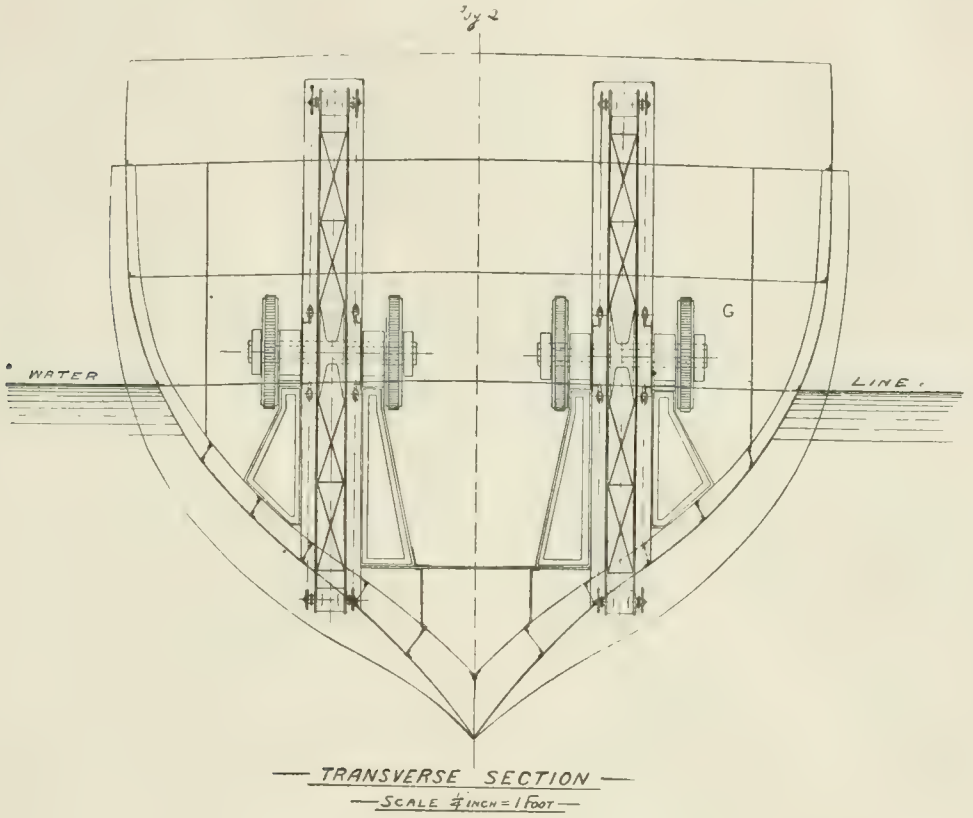
We will now put twin Spur Propellers in her, they having a radius of 22 ft. to the centre of effort of the blades, and taking Beaufoy's experiment of one square ft. area as a guide to find out the size of the blades afterwards, and the propellers making 50 revolutions a minute, and the circumference being 138·23 ft. and allowing one blade of one propeller doing full work at a speed of 6911·5 ft. a minute, the resistance to that one square foot blade area, travelling at the rate of 6911·5 ft. a minute is 14,861 lbs., and calculating the horse-power by the usual rule, it amounts to 3112 H.P. less friction of machinery.

And as all wheels are levers, we will calculate it on that principle, which is likewise a natural law, then the one foot

square area of blade having 14,861 lbs. resistance travelling through the water at 6911·5 ft. a minute, at the end of a blade arm 22 ft. radius, and the load or power arm or crank of any length that may be chosen, the horse-power will come to the same amount; that is, 3112 H.P. We will now find out the size of the blades and the total horse-power. First, we will put a 12 ft. driving wheel on the shaft of the propeller with a 6 ft. radius, more likely one on each side of the propeller to balance; this driving wheel or wheels will be connected to the engine shaft (each propeller and engine are separate) by suitable gearing.

Now the load on the driving wheel or power arm on propeller shaft with 6 ft. radius would be 54,490·33 lbs., and the 14,681 lbs. on the blade arm added together makes 69,351·33 lbs. on the fulcrum or bearing of the propeller shaft; from one square foot area of blade at work under the above conditions, and that a blade 4 square ft. area would give 123·88 tons thrust on one propeller shaft at 50 revolutions a minute, or 247·76 tons total from both propellers with 31,120 horse-power, having had 25 per cent. added to it for friction of machinery, etc. In addition, the *Kaiser Wilhelm II.*, on her record trip, averaged 44,600 horse-power, giving her an average speed of 23·58 knots an hour; the theoretical thrust on her from her twin propellers was 193 tons. The above-mentioned size of the Spur Propeller would be a suitable size for the *Kaiser Wilhelm II.*, that is, about 45 or 46 ft. in diameter, and a less size one would suit a ship the size of the *Drake*. Any competent person can calculate the above for themselves, and the same data is available to them as it is for me, which may be taken from the above.

What may strike the unthinking observer is the apparent smallness of the propeller blades, but that is only a misapprehension, as will be seen. For instance, Beaufoy's experiment of 1 ft. area is mentioned as being wholly submerged, and the speed only 600 ft. a minute, through which the hydrostatic pressure may have been nearly equal on both sides of the plate; however, the blades being 18·5 ft. below the surface of the water, the pressure per square inch on both sides of the plate when at rest would be 8 lbs., and on the square foot area over half a ton. Now that amount of resistance to a speed through the water of 6911·5 ft. is not calculated for in the above, nor would 31,120 horse-power drive it at that speed through water at that density, but it would drive it at such a speed that the resistance would balance the horse-power; which would give the total thrust on the ship of 247·96 tons. But there is, also, another view to be taken, and that is, if the speed of the blades travels faster than 32 ft. a second, a vacuum will begin to take place on the following or forward faces of the blades; the vacuum will necessarily be proportionate to the increased speed. Therefore, there will be a pull on the water at the following or forward side, adding resistance to the pushing or stern-



WILCOX'S HIGH SPEED SPUR PROPELLER FOR STEAM SHIPS

Fig 2.

ward faces of the blades, the blades will show that they are large enough for the horse-power; only one blade has been considered as doing full work, whereas it is thought that there will be more, probably 1½ or 1¾, as there will always be three blades below doing work.

It may be added that, according to the data given, the *Drake* at her 24·11 knots speed has 26 lbs. of theoretical thrust given to her from her twin-screw propellers from 31,409 horse-power for each ton of her displacement; if she had the Spur Propeller applied to her under the same conditions she would have 39 lbs. effective thrust for each ton of her displacement with 31,120 horse-power; similarly, the *Kaiser Wilhelm II.*, instead of 16·6 lbs., would have 21·28 lbs.

The inventor sees no reason why they could not do their 30 knots each if they had the Spur Propeller attached to them.

Moreover, it is recorded that the *Kaiser Wilhelm II.* pro-

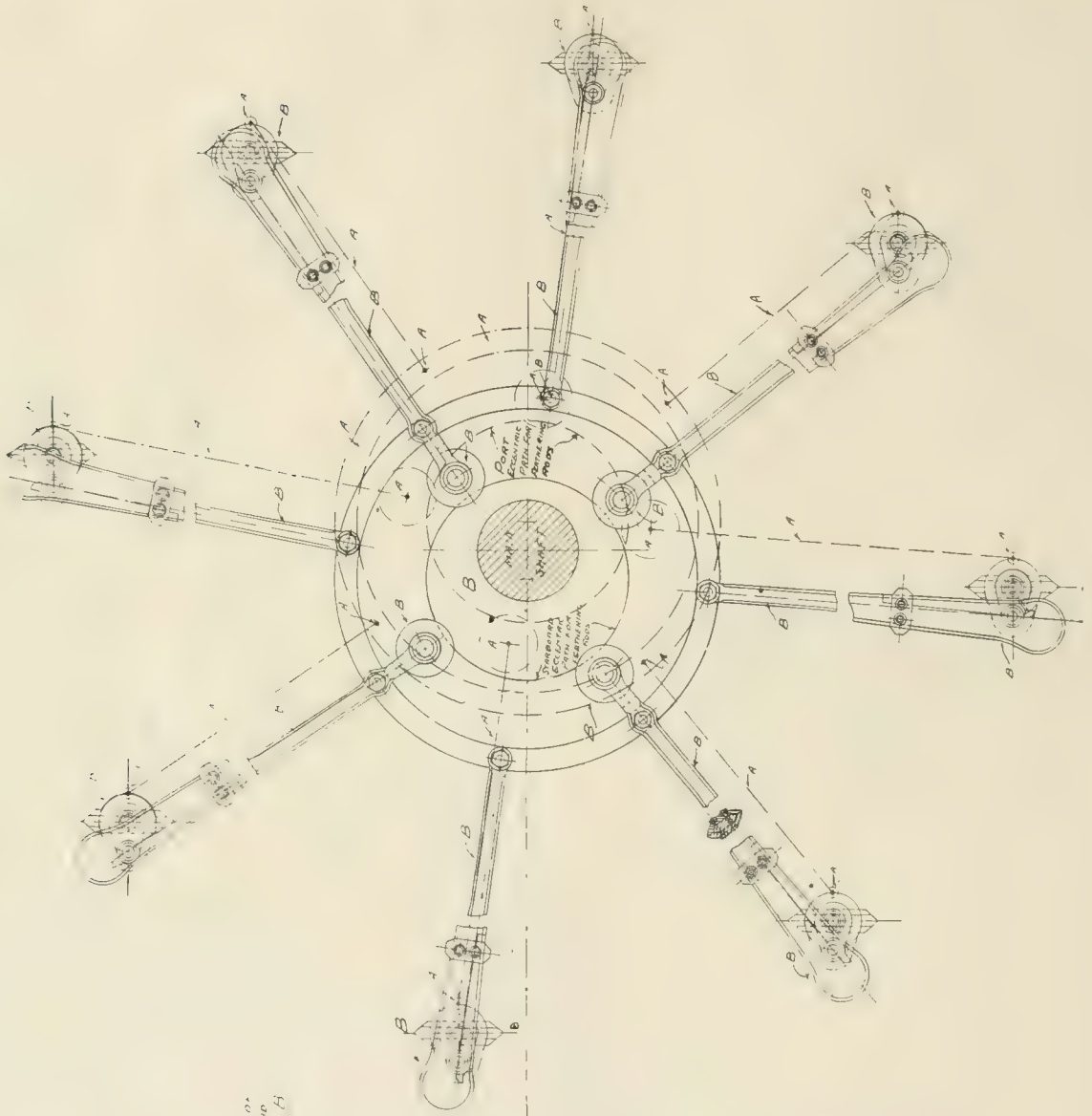

NOTE. CONNECTIONS A ARE ON THE PLAN SIDE
B " " STARBOARD
A " " B
SCALE 2" = 1 FOOT
PORT FEATHERING ECCENTRIC FEATHERING ROD
MAIN SHAFT
STARBOARD ECCENTRIC FEATHERING ROD

Fig. 3.

Wilcox's Spur Propeller

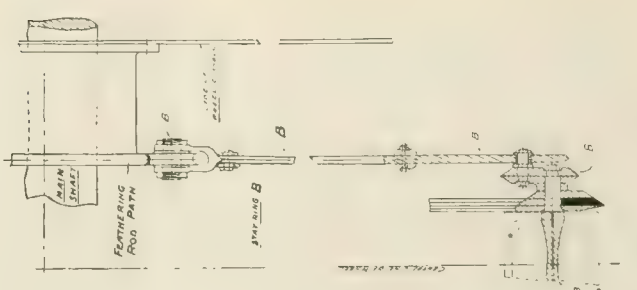


Fig. 4.

peller shafting is 608 ft. long for both, and weight 452 tons, but if she was fitted with the Spur Propeller, her propeller shaft would be about 54 ft. long and total weight about 40 tons, if the engines were directly connected with them; however, if she used gearing from a high-speed engine, the crank shaft would be an extra 45 tons, that is, a total weight of shafting of about 85 tons. And all other weights of boilers, coal, and machinery, etc., would be proportionately reduced.

Besides the above advantages shown by this propeller, the following additional uses are claimed:—

That it gives no sudden shocks nor strains on the machinery, nor vibration.

That the rolling or pitching of the ship has no influence on it.

That it is not affected by the lightness of draught of the ship.

That it is better protected from external injury than any other propeller.

That it can be repaired without going into dry dock.

That it produces no augmentation to the ship's resistance, like the screw propeller.

In conclusion, it may be stated that some years ago the inventor had an experimental steam launch made and fitted her with a screw propeller to get data for comparison. He then put a propeller of his own design in her, and under equal conditions, he beat the screw propeller 28·29 per cent. in speed, the principle of which was in propelling in deep water nearly directly astern and in feathering the blades by the aid of a horizontal submerged chamber.

We shall be pleased to forward any communications on the above subject from our readers to Mr. Wilcox.

Vessels Launched & Work on Hand during 1906.

ENGLISH.

By John Thomas Crampton, Albion Shipyard, Landport.

Name of Vessel	Built of	Class	Owners	G.T. Regis.	I.H.P.
"Fly"	Wood	Dumb	Native	38	
4, 40 ft. Steam Pinnaces ..	,,	Steam	Admiralty	60	300
1 Ditto,	,,	,,	,,	15	75
8 Floating Stages	,,	—	,,	50	

FRENCH.

By La Ste Anonyme Des Chantiers de la Gironde, Bordeaux.

† Topedo boats, Nos. 325 & 331	Steel	Steam	France	97	2,000

WORK ON HAND.

† Vérité	Steel	Steam	France	14,870	18,000
† 2 Torpedo boats	,,	,,	Foreign	302	6,300
† Tirailleur	,,	,,	France	426	7,800
† Vergniaud	,,	,,	,,	18,400	22,500

AMERICAN.

By H. D. Bendixson Shipbuilding Co., Eureka, Cal.

Svea	Wood	Steam	American	750	—
Hogniam	,,	,,	,,	750	—
Yosemite	,,	,,	,,	900	—

WORK ON HAND.

Daisy Freeman	Wood	Steam	American	750	—
Flaurence Ward	,,	Sail	,,	350	—
Yellowstone ..	,,	Steam	,,	850	—
Tahoe	,,	,,	,,	800	—
Shoshone	,,	,,	,,	750	—
Katherine.....	,,	,,	,,	650	—

By Kruse & Banks, successors to The Simpson Lumber Co., Oregon.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	I.H.P.
Washcalore	Wood	Steam	Native	365	300
† Casco	,,	,,	,,	502	500

WORK ON HAND.

† R. D. Inman ..	Wood	Steam	Native	600	—
† F. S. Loop	,,	,,	,,	600	—
† not named	,,	,,	,,	—	—

NEW ZEALAND.

By George Niccol, Auckland.

Korora	Wood	Sail	British	160	—
Zmgara	,,	,,	,,	210	—

By T. M. Lane & Sons, Auckland.

Grey Witch	Wood	Oil engine	Local	3	55

NOTE.—They build launches only at this branch and the one given above is the only one registered. All larger building is done at their shipyards at Totara North.

CHINESE.

By The Shanghai Dock and Engineering Co., Ltd., late S. C. Farnham, Boyd & Co., Ltd., Shanghai.

† Hainkong	Single	Steel	Steam	—	2,146	1,300
† Bremen..	Twin	,,	Tender	—	321	670
* Daisy ..	Single	,,	Towboat	—	197	490
* 5 launches	,,	Teakw'd	—	—	156	400
* 2 ,,	,,	Steel	—	—	115	250
Motor Oil Lighter	,,	,,	—	—	53	—
Motor launch	,,	Teakw'd	..	—	—	—
Gas lightship ..		Steel	—	—	180	—
6 cargo lighters		,,	—	—	1,302	—
2 benzine lighters					444	—
3 pontoons		,,			185	—

WORK ON HAND.

† Kian	Twin	Steel	—	—	1,217	700
Pontoon	—	,,	—	—	182	—

* Compound. *t* Turbine. † Triple.

The above arrived too late for our January issue.

Boiler Construction.—At the Institute of Marine Engineers' Rooms on January 14th, Mr. J. G. Hawthorn gave a lecture, specially for the Junior Section, on boiler construction, in the course of which he pointed out the principles on which the boiler is constructed to get the best out of it, both in respect to its work and its longevity. Treating first on the importance of designing a boiler with a view to the work it has to do, it is no less important to consider the process of manufacture and the most economical way of putting every part together with accuracy for it to stand the various strains to which each detail is subjected. The next point the lecturer dealt with was how to choose the class of material best adapted for the shell, the tube plates, fireboxes, stays and tubes, indicating the different properties of iron and steel, the brands most suitable for exposure to heat, with the percentage of carbon contained in these, and the qualities due to the percentages. Strength of material, margin of safety allowances, and rules for thicknesses of shells, fireboxes, furnaces and tube plates were next explained, also methods and rules for staying the various parts. In closing, Mr. Hawthorn showed how the firegrate heating surface and water and steam spaces influenced the evaporation, coal consumption and the indicated horse-power of the engine.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our own Correspondent.*)

A QUICKENING of enquiry for new tonnage was experienced on the Clyde, as in other centres, some little time before the cessation of work for the New Year's holidays, largely due no doubt to the settlement of the strike as to a rise in wages, on the basis that no such rise was warranted by the state of the shipbuilding industries or of the prospects before the shipping trade. A number of enquiries materialized before last month's notes were printed, and were briefly indicated in course of the notes, but a number of important orders which resulted were not noted, because of the importance of dealing with the work of 1906 as a whole. One of the orders referred to was for a large steamer of 400 ft. in length booked by Messrs. Alex. Stephen and Son, of Linthouse, for the United Australian service of the British India Association; another was for a cargo steamer 400 ft. long, 32 ft. beam, and of about 8000 tons deadweight capacity, ordered from Messrs. Chas. Connell and Co., Scotstoun, by Messrs. Chas. Barrie & Son, Dundee; while a third item of note, placed before the end of the year, was a steamer of 2200 tons deadweight, which the Campbeltown Shipbuilding Company are to build for owners they have already supplied with similar tonnage.

To the Fairfield Shipbuilding and Engineering Company, Govan, since the advent of 1907, has come the most notable fresh work, particularly so because of the promise which it gives of still more important work to follow. For the Canadian Pacific Railway Company the renowned Govan firm are to build two passenger and cargo steamers, each of about 350 ft. in length, 43 ft. beam and 27 ft. depth. The new vessels, which it is believed are to be propelled by turbine engines, are in respect of speed and passenger accommodation to be quite abreast of the highest standard of steamers on the Great Lakes, for which service they are intended. The capacity for cargo will be about 2300 tons on a draught suitable for all the conditions of service on the Great Lakes, and of access to the destined arena through the various canals.

The stocks at Fairfield have for some little time been somewhat bare of work, the most important item on hand being the cruiser *Indomitable*. Other naval contracts for which the company have really been reserving some of their capacity and forces not having come along, mercantile contracts of the class Fairfield takes to do with are thus being accepted. Besides the two Canadian Pacific steamers above referred to, intended for the Great Lakes service, it is believed that negotiations are proceeding for two high-class fast mail and passenger twin-screw steamers for the Trans-Atlantic service which are to be an advance even upon the highly successful *Empress of Britain* and *Empress of Ireland* built in 1904-5. For the new Egyptian Mail Steamship Company, Limited, just formed to establish a first-class fast mail and passenger service between Europe and Egypt, the Fairfield Company are now proceeding with the construction of two large turbine steamers, the order for which it appears was placed in August last. The keel and structural bottom of both vessels are well advanced in the yard. They are 550 ft. in length and 60 ft. in breadth; are to be propelled by five turbines (three ahead and two astern) through three lines of shafting, are to have a speed of not less than 20½ knots, which should enable the passage between Marseilles and Alexandria to be accomplished in 70 hours. They will each have accommodation for 500 first-class and 280 second-class passengers, and in the saloon and stateroom arrangements and appointments they will reproduce all the best features of the newest Atlantic liners. The turbine machinery for these splendid vessels will, of course, be made by the Fairfield Company themselves, and they will be of the Parsons type embodying modifications which the engineering designers and management at Fairfield have evolved from their experience with the turbine machinery already produced. Previous turbine steamers built by the Fairfield Company were the yacht *Narcissus* (the first twin-screw turbine vessel built) in 1904, the cross-Channel steamer *Dieppe* in 1905, and the Burns' Irish Channel steamer *Viper*, launched in April of last year. The new order for two turbiners thus runs the list up to five for which the Fairfield Company will have made the turbine machinery.

Messrs. David & William Henderson, ship builders and engineers, Partick, have been instructed to build a steamer of about 9000 tons deadweight capacity for Messrs. Ruys and Company, of Rotterdam, an order for a similar steamer having been given to Dutch builders.

Messrs. William Hamilton & Company, Port Glasgow, have received an order from the Rotterdam-Lloyd for a cargo steamer 393 feet in length, 51 feet 3 inches in breadth, and 23 feet 3 inches in depth, having a carrying capacity of 8000 tons, and a speed of 12 knots. The same builders have also received from the Stoomvaart Mattschappy Nederland an order for a steamer of about the same size as above.

Messrs. The Grangemouth and Greenock Dockyard Company have received an order from foreign owners to build two steamers of moderate tonnage. The vessels are to be built in the Company's Greenock yard, and will be supplied with machinery by Greenock and Glasgow engineering firms. This firm have also received instructions to build a number of steam drifters for the North of Scotland fishing industry.

Messrs. William Simons & Company, Renfrew, whose stocks and large engineering shops keep well occupied, launched on the 15th January, for the improvement and deepening of the port of Penang, Straits Settlements, a powerful bow-well, centre ladder, bucket barge-loading dredger named the *Crab*.

The Ardrossan Dry Dock and Shipbuilding Company, Limited, who have before evinced much enterprise in adopting plant calculated to enhance the constructive capacity of their yard—one instance being a large cantilever crane for heavy lifts—are now paying attention to the ship repairing department. On the 19th ult. they formally inaugurated a new hauling-up slip, which is of the most up-to-date description, and has been built to replace the old chain-rod system of haulage. The carriage is 153 feet in length, and is capable of receiving vessels up to 600 tons register. Vessels can be put on the slip by means of a double set of wire-ropes within twenty minutes, and may be slipped, painted and unslipped in one tide. On the 19th ult. the steamer *Enriqueta*, belonging to Messrs. Geo. Webster & Company, Glasgow, was hauled up for repair, and the work was expeditiously carried out. The new slip, together with a quantity of new plant, which has just been introduced to the yard, is expected to double the output of repair work. In both building and repairing departments the Company are at present very busy. On the same day as the opening of the slip, the Company launched a twin-screw cargo steamer named the *Carmelo*, 170 ft. in length by 32 ft. beam, built to the order of Messrs. Esplen & Son, of Liverpool, on behalf of foreign owners, and intended for river service in South America. Engines will be supplied by Messrs. Menzies & Co., Leith.

The Ailsa Shipbuilding Company, of Troon and Ayr, launched on the 10th January the screw steamer *Woodburn*, which has the distinction of being the first Clyde launch for the New Year. The launch took place from the Company's shipyard at Ayr, and immediately the vessel was afloat she was towed to Troon to receive her machinery, which has been constructed at the Company's new engineering works there. The new vessel has been built to the order of Mr. Chas. M. Legge, coal merchant, Carrickfergus, and is specially designed to meet the requirements of his trade. Of the work on hand in the two shipyards of the Company, two items are vessels for the West Highland service of David McBrayne, Limited. One of these is to be fitted with internal combustion machinery in place of the ordinary steam engine and boilers, which marks a new departure in the coasting class of cargo and passenger vessels. To be named the *Scout*, she is 100 ft. in length, and has to attain a high rate of speed on a light draught. The other vessel, to be named the *Chieftain*, is 230 ft. in length and is building at the Company's Ayr yard.

THE TYNE.

(*From our Own Correspondent.*)

Shipbuilding.—A few steamers have been laid up in the Tyne lately, and this is not regarded as an encouraging circumstance by those interested in the work of shipbuilding. Another bad sign is that at many of the yards there are empty berths, and at one establishment there is a nearly completed vessel on the stocks, on which constructive operations appear to have been suspended. This looks as if the vessel had been left on the builders' hands and if report speaks truly, this is likely to happen in other cases also. Notwithstanding the presence of these tokens of ill omen, orders for new tonnage, it is said, continue to be placed, and evidently there is a demand for types of steamers designed to meet particular requirements

A local contemporary gives the information that there are now in Germany eleven well-equipped shipbuilding yards, besides a number of establishments where only small craft are turned out. Looking through the list of German yards, however, given in the January special number (1907) of the *Marine Engineer*, and taking into account only yards that have launched vessels of over 1,000 tons capacity, we find that there are double the number mentioned in Germany, and if we extend our researches to other countries, we find that there are seventy-six yards, each of which has turned out vessels above 1,000 tons capacity, outside the United Kingdom. The same carefully prepared record tells us that there are just seventy-three yards in the United Kingdom, each of which launched last year ships of over 1,000 tons capacity. In all the world, however, outside the British Isles, only some half-dozen yards have launched over 20,000 tons, whilst we have thirty-seven establishments that have achieved that distinction. We may go further and state that three of our principal yards have, in the aggregate, turned out last year more tonnage than all the rest of the world put together. The comparison between our own production of tonnage and that of other countries, however flattering to ourselves, still provokes the enquiry—how long will our existing pre-eminence be maintained? There is no mistaking the fact that most foreign countries are making strenuous efforts to supply their own requirements in floating tonnage, and their progress during the past decade,—and especially that of Germany—has been somewhat startling. Britain is still the premier shipbuilding country, and will be, no doubt, for many years to come; but in view of the fact that Germany has more than doubled her output within the past five or six years, it behoves everyone who is interested in shipbuilding in this country, to assist in every way possible to maintain the lead we have.

In a former number, we noted that Messrs. Armstrong, Whitworth & Co. were carrying out extensive alterations at their Elswick yard. We have now to state that the Company's Low Walker establishment is also to be re-modelled, and the berths in the east yard have been allowed to remain empty with a view to the carrying out of the new arrangements. It is probable that the number of berths will be reduced to admit of larger berths being substituted. The machine shops are to be dismantled and refitted on a modern scale, and new shops are to be added. Several new machines of the most powerful type are to be put down and the general equipment of the yard will be made thoroughly up-to-date. In the western part of the yard there are two very large vessels in progress, and it is understood that the Company have orders for one or two others.

Messrs. Dobson have two vessels on the stocks, and Messrs. Wood, Skinner & Co. have three vessels in hand, and one in the water being fitted out.

Messrs. Robt. Stephenson & Co. launched their first vessel for the year on the 11th inst., and they have still four on the stocks. They have also a big warship in the graving dock, undergoing repairs.

Messrs. Hawthorn, Leslie & Co. have a couple of large vessels on the stocks and one or two in the water receiving their final service equipments. There is also a large passenger steamer in the graving dock, undergoing repairs.

Messrs. Swan, Hunter & Wigham Richardson have berths vacant in both their Walker and Wallsend yards, but notwithstanding this circumstance there is a considerable amount of work in hand. The Palmer Company's yard is rather bare of work at present; but it is stated that the firm have received some good orders lately, and it is expected that the yard will again be busy very shortly.

The Tyne Shipbuilding Company have as usual, three vessels in hand, and the Northumberland yard in the near vicinity has double that number on the stocks.

Engineering.—At all the marine engine works, the briskness that was noticeable last year is well maintained, and the state of business at the smaller works is also satisfactory. Steel works at Jarrow and other local centres, still keep busy, and iron foundries do not show much lessening of activity. The new foundry that has been erected at Hebburn for Messrs. Robert Stephenson & Co., is now quite ready for work, and we believe that operations on a small scale have already been commenced.

Messrs. Crosier, Stephens & Co., of 2, Collingwood Street, Newcastle, have been appointed by the Climax Patents Limited, agents for the sale of the new "Stox" pneumatic hammers, their district comprising the Tyne and north-east coast generally. As pneumatic tools are now coming greatly into favour among shipbuilders and others, it may be as well to mention some of the special advantages claimed for the "Stox" hammers. The chief advantage appears to be the elimination of vibration, a fault that has greatly hindered the adoption of other types. The absence of vibration in these hammers when at work, is brought about by a peculiar arrangement of the valve and piston, which, though quite novel, is entirely effective for the purpose intended. In addition to the doing away with vibration, it is claimed for the "Stox" hammer, that it costs 30 per cent. less to work than other makes for equal capacity, and that it costs practically nothing for upkeep and repair. The "Stox" hammers are manufactured for the Climax Patents Limited, by Messrs. Smith and Coventry, Manchester, who have put down special plant for dealing with this class of work. These hammers are well adapted for chipping and caulking and even for light riveting, and it will be strange indeed if they do not soon become widely popular.

THE WEAR.

(*From our Own Correspondent.*)

Shipbuilding.—It has not transpired that any orders have been booked on the Wear lately, but it is a matter very generally believed that two or three of the leading firms have booked ahead, and in these cases no slackness need be feared for a couple of years to come. In addition to the large amount of work in hand at the North Sands yard, Messrs. J. L. Thompson & Sons have an important repair contract at the Wear Commissioners' No. 2 graving dock. This is the repairing of the locally-owned steamer *Victoria*, which received serious damage through having been ashore. This firm have commenced the erection of new premises on a site adjoining the No. 2 dock, which they have leased from the Commissioners. The premises, when complete, will be equipped with adequate plant and accessories for the effective carrying out of repair work to both ships and engines. Messrs. S. P. Austin & Sons, have launched a vessel since the advent of the new year and have since placed a keel in the vacated berth. The firm are very busy with repair work and both the graving dock and the pontoon dock are being fully utilised. Messrs. Robert Thompson & Sons have a vessel in the Bridge dock under repair, and they are also repairing one in the river (the *Hercules*), which had been damaged by collision with another steamer at the entrance to the river. This repair is being effected with the full cargo of coals on board, which, we believe, is a very unusual circumstance. The firm have booked several contracts to be dealt with in succession (or simultaneously) in the near future, and it is expected that the works will be kept very busy for some time. The firm's copper smithing department is exceedingly busy, the work in hand being partly for themselves and partly for other firms. Sir James Laing & Sons have also a good deal of repair work in hand and their building

berths are all filled with vessels of a superior class. Messrs. Doxford have launched a vessel this year and another is nearly ready for putting off the stocks. The ss. *Coronation* has arrived in the port from Malta and is now open to tender for extensive repairs. It is probable that Messrs. Granwell will obtain the contract, their premises being close to the dock graving in which the vessel has been placed.

The Sunderland Shipbuilding Company are finishing the equipment of the fine steamer *Asiatic*, which was launched in December last and have a couple of vessels in early stages on the stocks. Messrs. Bartram have two large vessels in hand and Messrs. Blumer have their three berths occupied. Messrs. Priestman, Messrs. Pickersgill and Messrs. Osborne and Graham continue to have their machinery in full operation.

Engineering.—Messrs. John Dickinson & Sons, of the Palmer Hill Works, have already fitted with machinery a couple of vessels this year, and there is now another at the quay to be similarly dealt with. The other marine engine works are still showing evidences of prosperity. Messrs. John Lynn & Co. have plenty of work in the fitting and machine shops, but the foundry is not so busy as it was a couple of months ago. Messrs. Wigham, of Hylton are kept very busy, the main part of their work consisting of steering engines and winches for vessels building by Messrs. Doxford. The Monkwearmouth iron and brass founding works continue to be well supplied with orders and local electrical works are also doing well.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

MANCHESTER is now in direct steamship communication with about 200 ports in various parts of the world. A goodly portion of the earth's surface, however, is still without direct communication with us, *viz.*, Turkey, West Coast and South America, South Africa, China, Japan, Madras, Calcutta and Burmah. Live cattle to the number of 8,502 were landed at our docks last year, and only 29 were lost *en voyage*. Manchester is a splendid distributing centre for all classes of goods, especially food stuffs. Thousands of carcases were despatched last year to all parts of England and Scotland. Two hundred carcases have left the lairiages in one day. Buyers attend our market from London, Birmingham, Sheffield, Leeds and Scotland, and Germany has also lately taken meat foods from Manchester.

During January, the traffic on the Ship Canal has been more voluminous than usual. Among other arrivals of merchandise four Atlantic liners arrived within the first week, carrying 30,448 bales of cotton from America. This increased the total for the season by 40,000 bales over last season. Eight to ten thousand bales have since been received. The imports of Egyptian cotton for the season total 92,638 bales, being nearly 10,000 in excess of the number recorded at the beginning of 1906. The number of bales has been increased considerably since.

The Ship Canal Company intend to construct two piers or jetties on thesr property at a cost of £38,325 and £69,035 respectively. The bulk of the money will be expended in masonry, concrete, walling, timber, and ironwork. A statement of the expenses to be incurred under the necessary Act of Parliament has been deposited by the engineer of the Company at the Private Bill Office, Westminster.

It is estimated that nearly half a million tons of bale and case goods are packed in Manchester for export every year. The bulk of rougher cargo, such as machinery, and iron and steel goods are produced in districts nearer Manchester than Liverpool. Facilities for shipping are all that is necessary, and the Canal Company are continually striving to provide the accommodation required.

The total tonnage of timber employed by the ports of Liverpool and Manchester during 1906 amounted to 868,264 tons, which is the largest on record. Business was steady throughout the year and prices fairly regular. The imports for the year were as follows: sawn pitchpine, cubic feet, 1,160,000; pitchpine planks, 78,000; Quebec board pine, 688,000; birch logs, 104,000; birch planks, 372,000; spruce deals (standards), 71,800; pine deals, 6,980; Baltic deals, 21,300; Baltic flooring, 13,030; Galatz whitewood, 9,530; oak Canadian and U.S.A., 41,000 cubic feet.

The increase of 5 per cent. in wages granted to miners by the Coal Conciliation Board means to Lancashire colliery owners about £5,000 a week to the wages' bill. For the first time surface workers and datallers are participating in the advance. Taking the whole of the Federation area, the increased rate of wages will amount to nearly £30,000 a week.

The British Westinghouse Electric and Manufacturing Co., whose extensive establishment borders the Manchester and Salford Docks, has reduced its capital from £3,250,000, fully paid, to £1,875,000. The works have been found too large. The development of the home electrieal trade has been much slower than was anticipated. There have also been considerable alterations in the conditions of manufacture, arising out of changes in types of apparatus. During the early part of 1906 the contracts carried over from the previous year and certain other contracts resulted in a considerable loss. Since the close of the financial year, the orders taken show a large increase over those of the corresponding period of last year, and the trading results appear to warrant the conclusion that the business of the Company has reached a turning point. Offices have been opened in Buenos Ayres and Johannesburg, and reciprocal arrangements have been made with the American companies which are expected to increase the volume of business. At home, the condition of the home electrical trade is at present unsatisfactory, but foreign and colonial business is growing rapidly.

The Manchester iron market continues firm in all sections. Prices have been gradually rising for months. The same conditions practically rule in America and on the continents of Europe. The prosperous state of trade generally is the cause of the dearness of metal. Average quotations on the Royal Exchange are as follows: Scotch metal, delivered Manchester Docks; Eglinton, 74/6; Dalmellington, 74/6; Glengarnock, 75/-; Gartsherrie, 78/-; 2/3 per ton less if delivered at Heysham or Fleetwood, and 1/- less if landed at Preston. Middlesbrough iron, 70/-; Derbyshire, 68/-; Staffordshire, 65/-; Lancashire iron not on offer; Lincolnshire, 65/-; ditto No. 4 foundry, 63/-; ditto, forge, 61/-; Hematites, East and West Coast, f.o.t., 81/6; billets, 12/6 to 15/-; copper and tin vary every week, but the prices are excessive, and almost, if not entirely unprecedented. Seamless copper tubes, 14⅜d. per lb.; braized ditto, 14½d. and seamless brass ditto, 11⅝d. The high prices of tin and copper have seriously affected local brass founders. Since the above was in type, pig iron prices have shown a slight decline.

Manufactured iron prices as follows: steel bars, £7 17s. 6d.; angles, £7 5s.; tees, £7 12s. 6d.; flats, £7 10s.; channels, £7 7s. 6d.; joists, £7 10s.; iron bars, £7 15s.; steel boiler plates, £9 2s. 6d.; steel sheets, £9 5s.; hoops, £8 2s. 6d.

From November 25th to December 31st, 202 vessels were inspected by the port sanitary authorities of Manchester, an increase of 21 as compared with the corresponding period in 1905. Of these, 85 were found insanitary in some particulars. Dr. Dearden is endeavouring to devise a scheme for obtaining notification of all cases of sickness of whatever nature, and for preventing any case leaving docks without an assurance of the non-infectious character of the illness having been given.

The Lancashire coal trade, like that of iron, is enjoying a period of great prosperity. The miners' wages have been raised 5 per cent. and coal has gone up in conformity with the revised conditions of trade. The tonnage of coal shipped from the Canal for export and bunkering during 1906 exceeded any previous record. The total was 620,822 tons. Coal is now being exported from the Ship Canal to most European countries, and to South America and Egypt. Average quotations: Best house coal, 14/- to 15/-; secondary, 13/- to 14/-; common, 10/- to 12/- per ton at the pits; burgy, 8/- to 9/-; best slack, 7/3 to 7/9; medium, 7/-; common, 6/- to 6/6; coal for shipping and export, 10/- to 11/-; furnace coke, 17/- to 24/- per ton.

THAMES.

(*From our own Correspondent.*)

THE Port of London problem has, in some ways, entered on a new phase during the month, from the fact of its nearness to Southampton, which has advantaged so greatly by the transfer of a portion of the White Star fleet from Liverpool. It has been put forward that if the port had been brought up to date before the advent of big ships, instead of considering the matter as is being done to-day, there might have been a chance of the vessels calling at Southampton and terminating the voyage in the Thames. Be that as it may, there is still no want of interest regarding the great cause at stake. It is recognised that London is a cargo port, and if only the accommodation was equal to the biggest of vessels coming up the river, there appears to be very little reason now why they should not do so. The great problem has, therefore, received fresh interest, though we know the dredging of the estuary is incomplete and there are not the proper dock or pier conveniences for the loading and unloading of the largest ships. The Dock Company say they have acquired the land, but they were fettered by the uncertainty surrounding the question. They have now deposited a Bill in Parliament on the subject, which, if passed, would enable the Company to finish the dock by 1910. The Company were to bring their views before the General Shipowners' Society on the 23rd ult., and the Chamber of Commerce called their meeting for the 29th. It looks, therefore, as the Government will not take up the matter this year, as if the other powers that be were determined no stone should be left unturned to endeavour to arrive at some understanding. It is curious to note a complaint by shipbuilders that there is no dock on the Thames with a sufficiently wide entrance to take a modern battleship for fitting-out purposes, and it is sought to emphasize the fact that we are thus losing constructional work for men-of-war from this reason. If this is so, it is not only a question of the large mail boats finding proper berths but we are losing on our not being able to put battleships, such as are now being built, into commission with all equipment on board which is sure to be a very serious complaint.

Referring again to the dredging operations now in course of execution between Gravesend and the Nore, for the purpose of the contract, now a bucket dredger and four steam hoppers have just been delivered by Messrs. Fleming and Ferguson, of Paisley, for operating between Gravesend and the Mucking Light, and lower down between the Chapman Light and the Nore, a combined suction and hopper dredging plant is in hand. This is to be constructed by Messrs. Ferguson Bros., of Port Glasgow, who are to build a vessel 328 ft. long, 54 ft. beam, with engines of 2000 h.p. The design is to load on her 3500 tons in 50 minutes, and convey this at a speed of 10 knots, the pumps having a capacity of 13,000 tons of sand and water per hour. The channel to be formed from Gravesend downwards to the Nore is one of 1000 ft. wide and 30 ft. deep at low water. This vast scheme is necessitated, it will be understood, by the increase in the size of present-day vessels, and it will be gathered from the above that we are really on the way to make the Thames up to date already, whatever further facilities may be provided in the immediate future.

The London and India Dock Company's report states that after providing for interest on loan capital and dividends on preference stocks, there is an amount of £111,175 available and they propose to pay a dividend of 2¼ per cent. on the ordinary stock, leaving £3290 to be carried forward.

The P. & O. Company have had launched a new vessel on the Clyde called the *Nore*. She is a twin-screw vessel of 6700 tons, and will have accommodation for 50 first-class and 40 second-class passengers, to be berthed in outside cabins on the main deck. The vessel is one of four intended for the new direct intermediate service between London and Japan.

The two authorities controlling the river bridges have each something to say on this large question at present. There is the Blackfriars' Bridge widening to come forward shortly, which is a 3 years' undertaking, the whole of the west side of which will be removed and carried outwards 30 ft., the general appearance remaining the same as at present. No interference with traffic will occur above, and it is to be presumed the same rule applies as regards the stream below, though new piers will have to be built for which caissons will be sunk. This work is not sufficient to absorb all the City's energies, and it is being considered what steps if any, can be taken to improve Southwark Bridge, which is, as is well known, not what it might be in every way. With the other scheme in hand something may now be done in this new direction by the Corporation. The London County Council have sold the structure of the temporary wooden bridge at Vauxhall, which cost £40,000 in 1898, for the sum of £50, the contractors who have paid this price having to remove the timbers and steel girders as part of their bargain. Lighters will be largely employed in the demolition, for which a period of 4 months is allotted for removal. The same contractors have secured the contract for pulling to pieces as put it together, and the one should be as interesting almost from a river point of view as the other, though so much more speedy.

There is yet another scheme as regards the Dover-Calais Channel put forward, which is for the ferry which is to take trains across the straits and carry goods without break of bulk, if it comes into operation. The Inter-Continental Railway Company, Limited, is to bring a Bill before Parliament with this object, so we may expect shortly to hear more of the matter.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent*).

Barrow.—During the past month or six weeks the shipbuilding trade of this district has been decidedly of an unsatisfactory character, as the orders in hand have well nigh all been disposed of, and some new work expected has gone past the local firm, including, of course, the order for the *Superb*, which went to Newcastle at a much cheaper price than either Barrow or other firms tendered at. It is evident from this low quotation there will be in the immediate future some very keen cutting in prices for Admiralty work, as so many firms have so thoroughly equipped themselves for this branch of the trade, and it remains now to be seen which of the great concerns in the country possess the most eoncomic means of production.

The only order reported during the month at Barrow has been that for a survey steamer for the Indian Government. She will be 240 ft. long, 33 ft. in width and 15 ft. 3 in. depth of hold. She will be a steel screw steamer, and will be used for surveying service round the Indian Coast. This vessel was designed by the late Sir E. J. Reed, and two other ships designed by him, the troopships *Warren Hastings* and *Dufferin*, were also built at Barrow, together with the Chilian battleship, *Libertad*, afterwards bought by the British Admiralty, and now named the *Triumph*. Other important Admiralty work is being negotiated for with foreign Governments, but these matters naturally take some time to fix up, and especially so in these days when the designs of vessels are being so constantly altered and improved. There are also some good mercantile orders in the market which local builders are looking after, and although at the moment none of this has been fixed, there are prospects, if not definite indications, which lead to the belief that the very quiet time lately experienced in the shipbuilding trade of Barrow will soon give way to a much more active state of things.

Vickers, Sons & Maxim are still going on improving their yard in every department in order to make it thoroughly up to date, and with this view are adopting the best appliances which experience and science can dictate, even if it is necessary, as it frequently is, to take out machinery which is comparatively new and which has not had much life in the works.

Work was stopped some few weeks ago on the Brazilian battleship now building in the Barrow yard, because of the determination of the Brazilian Government to alter the design. This has now been done, and the consequence is that the vessel will now be considerably longer, and will be more powerfully armed. The work of constructing this ship has been recommenced, and as there is not at the moment

much other work in the yard, it is expected the vessel will be built in a record time, and especially so as it is hoped other orders of some importance will soon be occupying the attention of the firm.

Considerably attention is being devoted to the building of submarines for His Majesty's Government. Five of these vessels are under construction at the moment, and as soon as they are completed their places will be taken by other submarines of the D type, which are much larger than those of the C type now being built. Indeed, submarine construction, like other shipping construction, seems to be always in a state of evolution. The A class was soon improved upon by the B class, and this was again still further improved upon in the C class. Now the D class is on its trial, and it is known to be a much larger vessel than any of these sub-aqueous ships already designed and built, and it is intended to do its work more in the open sea, with which view it has been given greater radius of action, and an accelerated speed. Submarine B2 left Barrow on Nov. 26th for Portsmouth.

The engineering department of the works at Barrow is well employed, mostly on gun mountings, indeed, the trade in the marine department has become so quiet that most of the tools have been utilized for mountings in connection with the big guns for battleships and garrisons made by the Vickers' firm, and even the engine erecting pits have been thronged with the heavy boiler work and turntables for these heavy guns. But there are indications that the marine department will soon be very busy also with marine engine construction, as there are not only the engines for the Brazilian battleship to build, but the firm have secured the contract to build the engines for two other Brazilian battleships building at Newcastle. This will make this department very busy, but there is still other important work pending in the marine department which is likely soon to mature.

There is probably no engineering establishment in the world so completely fitted up for a very large output, and certainly not one which is better equipped with modern machinery.

The first-class cruiser *Natal* armoured and protected, will be handed over to the British Government on the 15th of February. She has already undergone most successful trials. The first-class Russian armoured and protected cruiser *Rurik* is being fitted with her engines, boilers and general fittings, and will be well nigh ready for delivery at the end of this year. The two Peruvian cruisers built at Barrow will soon be ready to cross the Atlantic to the East Coast of America, and it is not improbable that other orders will come from the same source, as it is known that these vessels are only the beginning of a new navy for Peru.

West Cumberland.—The shipbuilding trade of West Cumberland is kept well employed, although the work done is only in small tonnage vessels. These, however, can be cheaply built, and new orders always follow those which are from time to time completed, making a general steady run of work which is in itself an economic feature of the production.

Shipbuilding Material.—The demand for shipbuilding material has been quiet during the month, and the mills have not been regularly employed, but orders have been more freely booked of late, and it is probable that full time will prevail at the plate mills in this district. Heavy plates are quoted at £7 15s. per ton net cash.

Hematites.—The hematite trade is very firm, and the demand is brisk, makers maintaining a maximum production with 35 fire furnaces in blast. Maker's iron is at 81s. per ton net f.o.b., and warrant stocks are at 79, 665 tons.

Shipping.—The shipping trade is well employed, and shows an increase of 17,822 tons over the corresponding period of last year.

BELFAST.

(*From our own Correspondent*).

LLOYD'S quarterly returns give the amount of work on hand at the Belfast shipbuilding yards on 31st December, 1906, as 174,770 tons. At the fitting-out wharves there are vessels with an aggregate of 80,000 tons odd. Enquiries for several vessels of high class have been received, and it is expected that this tendering will result in some important contracts being fixed locally. According to a Philadelphian newspaper correspondent, if the statement of Raphael Castro Milago, a wealthy Manila merchant, are confirmed, Belfast shipbuilders amongst others are to be asked to tender for the construction of seven large steamers for a new Jap-Philippine shipping company. It is stated that these steamers were to have been built in the United States, but attempts to come to terms with builders there proved abortive, American tenders being characterised as "outrageously unfair and ridiculous, as everything else American."

The new steamers *Aburi* and *Sierra Leone*, built and engined by Messrs. Harland & Wolff for the African Steamship Company, had highly satisfactory trial trips on the 2nd and 8th of January respectively. Full particulars of these vessels have already appeared in the *Marine Engineer*. They are the first of four similar vessels ordered from the Queen's Island by Messrs. Elder Dempster & Co. The *Fulani*, the third of the quartet, will be put in the water on the last day of January. The White Star liner *Adriatic* is intended to sail from Liverpool for New York *via* Queenstown on her maiden voyage on 8th May, and the regular weekly sailings from Southampton will be inaugurated with this magnificent vessel on 5th June. Messrs. Harland and Wolff have the Orient Royal Mail liner *Oruba* in hand for general overhaul and structural alterations. The *Oruba* is a sister ship of the *Orotava*, which was recently brought up to date by them. They have also the Belfast Steamship Company's s.s. *Magic* laid up for annual survey and overhaul. Two more Queen's Island built steamers have been acquired by the Hamburg-American Company, namely, the *Albano* (ex Iran) and the *Barcelona* (ex Arabia), built in 1886 and 1896 respectively. Both vessels formerly belonged to the Sloman line of Hamburg. Reference was made in last month's notes to the stranding of the cable ship *Anglia* while on a voyage to Belfast for alterations at the hands of Messrs. Harland & Wolff. Salvage operations are still proceeding, and, despite the fact that the vessel lies in an extremely critical position, the officer in charge of the work reports that he is confident of the vessel's being successfully floated.

Messrs. Workman, Clark & Company have not launched any vessels during the month of January, but they have a very considerable amount of tonnage at the fitting-out berths: the new City liner *City of London*, and Messrs. Elder Dempster & Co.'s new steamers *Salaga* and *Gando*; also Messrs. Houlder Bros.' *Beacon Grange* for repairs, as reported in a previous issue. At time of writing, the magisterial enquiry into the cause of the disastrous fire by which this vessel was entirely gutted amidships, is being brought to a conclusion. When the case is finished the complete evidence will be forwarded to the Board of Trade.

The Goorkha.—The life history of a ship, as of an individual, is only of interest for the work accomplished or for the special association attached to it. Many pass away without a regret, others even give a sense of relief at their absence. Usually when the story of work achieved comes to be written it is mingled with regret that the prime movers are laid to rest and have run their course. These and similar reflections were induced on witnessing the departure, early in January, for the last time from the Royal Albert Dock, of the *Goorkha*, she having changed ownership; and along with change of ownership, the Italian flag proclaimed a change of nationality as she steamed away down the Thames. The *Goorkha* was a popular ship with passengers to and from the East. She was referred to in our issues of June and October last in connection with the retirement and the funeral respectively of her popular chief engineer. The *Goorkha* had run for twenty-five years steadily, making a mileage of approximately 1,360,000, representing about 250,000 tons of coal since she was launched from Dumbarton in 1882. To many of our readers, who have been associated more or less intimately with the ship, it will be of interest, as well as a matter of regret, to know that the place which knew her for so many years shall know her no more.

JUNIOR ENGINEERS.

V*.

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Moulding.

THE nature of the work carried on in the foundry has given little scope for the introduction of mechanical novelties, but semi-automatic moulding machines are being more largely adopted, especially for light repetition work, for making large gear wheels, and for core-making; the remainder of the plant consists mainly of machines and erections for preparation of material, this equipment being governed by the output and class of work undertaken.

The jib crane has been superseded by the overhead traveller, the electrically driven type being more suitable, owing to the more uniform lifting and starting effort with higher traversing speeds.

Pulverizers for grinding down the sand consist of a fixed circular pan having two rolling wheels which rotate about their own axes and also about the axis of and inside the pan, the height of the rollers being adjustable to suit the degree of fineness required. For the mixing of the ingredients of the sands, the pulverizers are frequently employed; it is better, however, and more usual, to use a separate machine, having rotating arms which churn and intimately mix the materials. To separate the sands into the various degrees of fineness and to remove foreign matter, a sifter is employed, power driven, to give a to and fro motion, either by means of a belt or a small portable electric or pneumatic motor, according to the conditions of the shop.

Dressing or fettling the castings, to remove headers, fins and ragged parts, is performed by circular saws and emery buffs, filing and chipping being resorted to where machine methods cannot be employed, and in the case of the smaller castings the rough parts are toned down by rumbling them in a mill filled with iron oxide.

The cupola for melting the pig iron is similar in form to a small blast furnace. A cylindrical tower of riveted plates is lined with firebrick to the thickness of from 6 to 9 inches, the internal diameter ranging from 2 to 7 feet; air is admitted by means of belts of tuyeres, the lowest being just above the hearth, the number of belts and the height being adjusted to suit the capacity of the cupola; in some types a centre blast is also provided. During melting, the earthy matter that has been introduced with the metal forms a slag, which by itself is infusible, hence a flux is put in to form a molten mass which floats on the surface of the metal, this slag being either drawn off through a separate tapping hole or, after the metal has been run off, the cupola is cleared of slag to prepare for another melting. By tapping the slag before all the metal is run off, another melting may be arranged for without clearing the hearth, but the more general practice is to make the cupola with a drop-bottom on hinges, so that the slag can be emptied into the pit below the floor. At a convenient height in the cupola a charging door is fitted, by means of which, from a platform, the fuel and metal are placed in layers alternately. A sprinkling of sand having been spread over the hearth a coal or coke bed is laid to start the fire, then a layer of pig iron, one of scrap iron, and another layer of fuel; coal or coke, or sometimes a mixture, is used in the proportion by weight of about 1 of coal to 6 of iron, or 1 of coke to 9 of iron, depending on the quality of materials and construction of the cupola; the flux above mentioned is put in in the same manner, this material may be limestone, oyster shells, marble chips or air-slaked lime, the quantity varying as the other mixtures. Successive layers of the materials are charged into the cupola up to the level of the door, which is then closed, the outlet for the waste gases being up the chimney through the roof. Where, as in the most modern foundries, both fuel and metal are analysed the proportions can be accurately gauged and the best results obtained.

When the iron is ready for drawing off, the plug is removed from the tapping hole and the molten mass run into the ladles. These ladles may be either of riveted or weldless steel plate formed with a lip for pouring, having fixtures for lifting at the sides, and gear for tilting while filling the mould. The inside of the ladle having been roughened, a wash of clay water is applied, then a loam lining is plastered on to a thickness of an inch or so, and dried by heating.

The air blast for the cupola is produced either by means of blowing engines, centrifugal fans or positive blowers; for foundry work the blower is the most suitable, as the velocity and pressure of the air can be more easily regulated than with the fan, those of the Roots' and Baker's types being the more generally used, in which rotary pistons of a convenient length gear into one another. The most recent practice is, however, to supply the blast by means of turbines, a steam turbine on one end of the shaft being directly coupled to the air compressor at the other, and so successful has this method been that whole blowing plants have been scrapped and turbines installed, with great increase in efficiency and reduction in vibration and noise.

For drying cores and dry sand moulds firebrick stoves are employed, heated either by direct firing or by waste heat from the furnaces of the boiler or melting plants, a steady draught of hot air being kept continuously flowing through the stoves to carry off the steam generated in the moulds. In some foundries, especially those in which heavy dry sand castings are made, hot air ducts were led beneath the floor into the moulds for drying purposes.

For melting small quantities of brass, where several alloys are required at the same time, crucibles are used, these being heated in a brick furnace with direct firing. The crucibles are either of fire clay or of plumbago mixed with clay, the latter being the more generally used. When, however, large quantities of brass are required the reverberatory furnace is employed. This consists of a firebrick chamber heavily stiffened on the outside by means of plating and tie rods; heated air is admitted below the fire grate, the heat impinges on the low roof and is projected down upon a sloping bank of firebrick; upon this bank, the upper end being at the hearth, the metal is charged through a door, the molten brass being drawn off from a basin at the foot of the bank, this being also the chimney end for the escape of waste gases.

The reverberatory furnace was formerly employed for melting cast iron, but, although with some classes of pig giving sounder castings, it has been superseded by the more economically fired cupola. One effect of using this type of furnace is that it reduces the silicon in the iron, and low silicon being an essential quality for the making of chilled castings, it may be found cheaper to employ this method where chilled castings are only occasionally made, rather than import a pig specially low in silicon.

Steel for castings was formerly made by means of the Bessemer converter, and although the Siemens-Martin process has almost entirely been adopted, the older style is still in use. The converter is a steel plate shell heavily lined on the inside with a refractory material; this lining was at first a mixture of silica, alumina and magnesia, the silica representing about 80 per cent. of the whole; this material, called ganister, has acid properties and the pig iron used was necessarily very low in phosphorus. With the introduction of the basic lining of magnesium limestone, a phosphoric iron was enabled to be used, a similar result being obtained with the Siemens-Martin process. The converter is mounted on trunnions, and molten pig having been introduced at the open neck at the top, air is blown into the iron through holes in the bottom plate. The impurities are thus oxidized out and when the whole of the carbon has disappeared the flame burning at the neck will cease; a known quantity of carbon is then introduced in the form of spiegeleisen or ferro-manganese, materials rich in carbon, and the metal poured off into the moulds. With the basic lining the blast is continued rather longer, giving off oxide of iron, the slag is then cleared off before the carbon is put in. The Siemens-Martin furnace is a modification of the reverberatory, producer gas being used for fuel, and the air for combustion heated in a regenerative furnace by alternately passing the air and the products of combustion through an open brickwork setting. The impurities are removed from the iron and carbon introduced in the same manner as in the Bessemer process. The great advantage of this later method is that the steel is more under control, samples can be taken and tested while the metal is still molten, and although a more lengthy process the steel is of a more reliable character than that produced in the Bessemer converter.

* For Articles I. to IV., see last four issues.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Steel Screw Steamer.—On December 18th there was launched from the yard of the Sunderland Shipbuilding Company, Ltd., a steel screw steamer 190 ft. in length between perpendiculars, by 29 ft. 10 in. broad by 13 ft. deep. having raised quarter deck, short bridge and top-gallant forecastle, classed British Corporation under special survey, the deadweight carrying capacity being 900 tons upon a light draught of water. Accommodation is placed in the poop for captain and officers, and for engineers in house on quarter deck, whilst the sailors and firemen are berthed in the forecastle as usual. A large donkey boiler is supplied, together with three steam winches, steam steering gear and direct steam windlass. The machinery is by Messrs. MacColl & Pollock, Sunderland, having cylinders 20 in. and 44 in. by 27 in. stroke, steam being supplied by an extra large boiler working at a pressure of 130 pounds per square inch. The vessel has been built to the order of P. M. Tegner, Esq., of Copenhagen, and during construction has been inspected by Mr. D. Rankin, of Sunderland, on behalf of the owner.

Ruby.—On December 19th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 125 ft. by 22 ft. 6 in. by 13 ft. moulded. The vessel has been built to the order of Messrs. Cole, Carter and Galvin, of Milford Haven, and will be fitted with powerful triple expansion engines by Messrs. Amos & Smith, of Hull. The vessel is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Ruby* by Mrs. Robert Cole, of Milford Haven, wife of one of the owners of the vessel, after which the company adjourned to the builders' offices, where breakfast was served, and the customary toasts given and responded to.

Roanoke.—On December 28th Messrs. Furness, Withy and Co., Ltd., Hartlepool, launched the finely modelled clipper steamer *Roanoke*, which they have built to the order of Messrs. The Chesapeake and Ohio Steamship Company, Limited, London. The vessel is 385 feet in length, built on the shelter deck principal with a tier of beams, and has large measurement capacity. The hatches are of large size, special attention has been paid to all derricks and lifting gear, the tween decks are available for carrying cattle, accommodation is arranged on the shelter deck for the master and officers, and the crew will be berthed in the forecastle, and steam heaters will be fitted in the accommodation. Nine powerful steam winches, steam ash hoist, winch condenser, fresh water condenser, cellular double bottom and large after-peak tank for water ballast, and all up-to-date auxiliaries will be included in the outfit. Triple expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, and the sizes of cylinders are 25 in., 40 in., 68 in. by 48 in. stroke, with three single-ended boilers 14 ft. 6 in. by 11 ft. long, 180 lbs. working pressure per sq. inch to pass German Law requirements. The vessel has been built to British Corporation classification.

Washington.—On January 12th Messrs. Richardson, Duck & Co., launched from their yard at Stockton-on-Tees a steel screw steamer of the following dimensions, *viz.* :—Length overall, 392 ft. ; breadth extreme, 52 ft. ; depth moulded, 30 ft. 4 in., and estimated to carry about 8400 tons on the shallow draught of 24 ft. 3 in., and to steam 10 knots loaded in fine weather. She will take Lloyd's highest class and has been built under special survey. The vessel is single decked, having deep frames of bulb angle, with poop, bridge and T.G. forecastle, 7 holds, each divided by steel bulkheads both 'thwartships and longitudinally, with hatches far larger than is usual and fitted with coamings of the exceptional height of 4 ft. 6 in. to ensure plenty of feeding capacity, as well as the maximum security in a heavy sea. The engines are being fitted by Messrs. Blair & Co., Ltd., with three boilers to work at 180 lbs. pressure. Wailes, Dove & Co.'s bitumastic enamels were applied to bunkers and boiler-room tank, and their bitumastic covering to the tank top in boiler-room. Special attention has been given throughout to the accommodation of the crew and officers, which works out to an average of 450 cubic feet per man, being over 370 feet in excess of the new Board of Trade requirements. The sailors and firemen are accommodated in the poop, giving the maximum of light and ventilation with a head room of 7 ft. 6 in., all the bed berths being of galvanized iron with spring mattresses. They have also a wash-house and bath-room. Accommodation for engineers and apprentices is in special houses on the bridge deck, 7 ft. 6 in. high, fitted in the most up-to-date manner for comfort. Galvanized iron bed berths with spring mattresses, together with bath-room, etc. Captain and officers are accommodated in saloon house on bridge deck amidships. Another feature of the vessel is that in many respects she is far in excess of Lloyd's requirements, the weight of the extra material being about 100 tons. The vessel is designed for the general cargo trade, more particularly the Mediterranean and the Black Sea. She is to the order of Messrs. Evan Thomas, Radcliffe & Co., of Cardiff, and is the 11th vessel built by Messrs. Richardson, Duck & Co. for that firm, and a duplicate of the s.s. *Patagonia* and s.s. *Picton*, which they have recently completed and delivered to Messrs. Evan Thomas, Radcliffe and Co. As the vessel left the ways she was christened *Washington* by Mrs. E. T. John, of Riversdale, Eaglescliffe.

Barge.—On January 15th Messrs. J. Scarr & Son launched from their Howden yard a steel barge built for Messrs. West Norfolk Farmers' Manure and Chemical Co., of King's Lynn, this being the second order the builders have received from the above firm. The vessel has a carrying capacity of 70 tons, and is of the following dimensions : Length, 65 ft. ; beam, 13 ft. 6 in. ; depth, 5 ft. 3 in.

Cleon.—On January 17th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 128 ft. 6 in. by 22 ft. by 12 ft. 6 in. moulded. The vessel has been built to the order of Messrs. The Orient Steam Fishing Co,. Ltd., of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. The Great Central Co-operative Engineering and Ship Repairing Co., Ltd., of Grimsby. The vessel is fitted with a whaleback forward and hood aft, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Cleon* by Mrs. W. J. Barrett, of Grimsby, wife of one of the directors of the company, after which the company adjourned, and breakfast was served and the customary toasts given and responded to.

LAUNCHES—Scotch.

Lord Sefton.—On December 29th Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer *Lord Sefton*, which they have built for Messrs. John Herron and Co., Liverpool. The vessel is of the following dimensions, *viz.* :—Length, 386 ft. ; breadth, 48 ft. ; depth, 30 ft. 4 in., and is designed to carry a deadweight of 7200 tons. Machinery of the triple expansion type having cylinders 26 in., 42 in. and 70 in. by 48 in. stroke is being supplied by Messrs. Rankin & Blackmore, Greenock. Both vessel and machinery have been built to Lloyd's highest class under the superintendence of Mr. E. C. Given, of Messrs. Flannery and Given, Liverpool. The naming ceremony was performed by Mrs. W. M. McMillan, Dunvegan, Dumbarton.

Woodburn.—On January 7th there was launched from the Ayr yard of the Ailsa Shipbuilding Co., Ltd., the steel screw steamer *Woodburn*. She has been built to the order of Mr. Charles M. Legg, coal merchant, Carrickfergus, and is specially designed to meet the requirements of his trade. On leaving the ways the vessel was gracefully christened by Miss Ada Wallace, Wandon, Troon. Immediately after the launch the vessel was towed to Troon to receive her machinery, which has been constructed at the Company's new engineering works there.

Cooma.—On January 15th Messrs. Alex. Stephen & Sons, Ltd., Linthouse, launched the steel screw steamer *Cooma*

of about 3800 tons, built to the order of Messrs. The Howard Smith Company, Limited, of Melbourne, for service in Australasian waters. Her dimensions are 330 ft. by 46 ft. by 32 ft., with engines 28 in., 46 in. and 75 in. diameter by 48 in. stroke, steam being provided by four large boilers. She has been built to the rules of the British Corporation, and under the supervision of Mr. W. E. Forster, of the Howard Smith Company. The *Cooma* has been elaborately fitted up for a large number of 1st and 2nd class passengers, the whole of the upper tween decks being divided into state rooms, with further accommodation, dining saloons, music rooms and smoke rooms in the deck-house above. The second-class accommodation especially shows a great advance on what has been formerly provided on the Australian coast, but the ship throughout is a mass of the latest appliances for the comfort and safety of the passengers, and the speedy handling of cargo. Among the fittings may be mentioned hydraulic cargo gear, fitted by Bow, McLachlan & Co. Large refrigerated chambers for stores and cargo, and fruit holds fitted with electric ventilation, while the accommodation is also thoroughly ventilated by a system of trunks and electric fans. The *Cooma* has been designed to maintain a high speed on service, while carrying a considerable quantity of cargo. The naming ceremony was performed by Mrs. Gerrit Smith, wife of Captain Smith, of the Howard Smith Company.

Crab.—On January 15th, for the improvement and deepening of the port of Penang, Straits Settlements, Messrs. Wm. Simons & Co., Ltd., Renfrew, launched a powerful bow-well, centre ladder, bucket, barge-loading dredger named the *Crab*. The dredger has been constructed under the direction of Messrs. Coode, Son & Matthews, civil engineers, Westminster, assisted by Mr. Robert Anderson, Renfrew, local inspector. The *Crab* is classed at Lloyd's. Propelling power is provided by one set of triple expansion surface condensing engines supplied with steam from a steel boiler of Scotch type, constructed for a working pressure of 160 lbs. per square inch. Auxiliary plant, of most modern type, including independent circulating pump for circulating purposes, independent feed donkey pumps, evaporator, etc., is fitted up in engine-room. The dredger's buckets have a total dredging capacity of 350 tons per hour, the maximum dredging depth is 30 feet below water level. Suitable clutches are provided for disengaging to and from the propelling engines and dredging gear. The arrangement of the dredging gear allows the dredger to make its own passage through banks and shoals. Comfortable quarters are provided for the officers and crew, and a complete electric light installation is fitted up on board, so that the dredger may be kept continuously at work, night and day, if required.

Kasama.—On January 17th Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer, *Kasama*, the second of two vessels which they have built to the order of Messrs. Bucknall Brothers, London. The *Kasama* is of the following dimensions:—Length, 413 ft.; breadth, 50 ft.; depth, 29 ft. 10 in., with long bridge having accommodation on top for captain, officers and engineers, besides a number of spare state rooms, while the poop is fitted for a native crew. Electric light is fitted throughout, and the vessel has all up-to-date appliances for the rapid handling of cargo, including derricks, etc., for heavy lifts and is designed with fine lines. The machinery is being supplied by Messrs. Dunsmuir & Jackson, Ltd., Glasgow. The vessel has been built under the superintendence of Mr. H. A. B. Cole, M.I.N.A., M.I.M.E., M.I.C.E., London. The naming ceremony was gracefully performed by Mrs. Miller, wife of the manager of the Bucknall Steamship Lines, Ltd., London.

LAUNCH—Irish.

Gando.—On December 20th Messrs. Workman, Clark and Company, Limited, Belfast, launched from their North Yard a large cargo steamer named the *Gando*, which has been built by them for Messrs. Elder, Dempster & Company, of Liverpool. The *Gando* is a sister ship to the *Salaga*, which was launched on December 15th from the South Yard of the above firm, and which was fully described in our last issue, page 238.

TRIAL TRIPS.

O. A. Knudsen.—On January 8th, the steel screw steamer *O. A. Knudsen* (of which we gave particulars in our December issue, page 170), built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of Knut Knutsen, Esq., O.A.S., of Haugesund, was taken to sea for her trial trip, which proved highly satisfactory. Her engines have been constructed by Messrs. John Dickinson & Sons, Ltd., Sunderland, the cylinders being 24½ in. 40 in., 66 in. × 45 in., with two large steel boilers working at 180 lbs. pressure, and on the trial trip, a mean speed of 11¼ knots was obtained. The owners were represented by O. L. Dahl, Esq., of Bergen, their superintendent engineer, who expressed himself as being highly pleased with the ship and engines. After the trial trip, the vessel proceeded to the Tyne, under command of Captain H. Paulsen.

Immingham.—On January 11th, the ss. *Immingham*, which has been built by Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, for the Great Central Railway Co., was taken out to sea for her six hours' official trial trip. The *Immingham* has been built for the company's passenger and cargo service between Grimsby and Rotterdam and is of the following leading dimensions: length overall 282 ft., beam, 41 ft., and depth moulded, 21 ft. 6 in. Accommodation has been provided for a number of first and second-class passengers, the first-class state-room being in the bridge with a certain number of better rooms on the bridge, and the second-class accommodation in the poop. The machinery has been constructed by the Wallsend Slipway and Engineering Co., Ltd., Wallsend, and consists of three Parsons' turbines driving three shafts, steam being supplied by four large single-ended boilers working under Howden's system of forced draught. On the trial trip, the machinery worked with perfect smoothness and without the least vibration and a mean speed of 18·3 knots was maintained over a trial lasting six hours, the vessel being loaded to a draught of 16 ft. The owners were represented on the trial by Captain Jackson and Mr. Mills, from Grimsby, Mr. F. J. Trewent and Mr. W. E. Proctor, the naval architects and engineers for the owners, who expressed themselves as highly satisfied with the performance of the vessel.

Lebu.—On January 17th, the steamer *Lebu* (of which we gave particulars in our December issue, page 170), built by Earle's Shipbuilding and Engineering Co., Ltd., Hull, to the order of the Compania Sud Americana de Vapores (Valparaiso) was taken for her official trial trip. The trials proved highly satisfactory to all concerned, the engines working easily and the boilers developing ample steam pressure. The steering and seaworthy qualities of the vessel were also tested. The owners were represented by Messrs. T. Dewsbury & Brown and the builders by Mr. A. H. Tyacke. The *Lebu* is a sister ship to the ss. *Teno*, built by Earle's Company, which has arrived at Valparaiso on her maiden voyage.

De Greve.—On January 19th, the new steamer *De Greve* built by the Blyth Shipbuilding Co., Ltd., to the order of Messrs. Koninklijke, Paketvaart Maatschappij, Amsterdam, was taken to sea for trial. This vessel, which measures 343 ft. by 47 ft. 3 in. by 24 ft. 5 in. moulded, has been built to Lloyd's Highest Class (Special Survey), and is of the single deck type, and has poop, long bridge and forecastle. A special feature in the *De Greve* is the absence of hold beams, thus providing exceptionally clear holds. Saloon, captain's cabins, and accommodation for officers and engineers are arranged in deck houses on bridge deck, whilst the crew are berthed in topgallant forecastle. The steamer is specially adapted for the grain and timber trade, having five large cargo hatches with double derricks for expeditiously loading and discharging cargo. Deck machinery of the most improved type has been supplied, including five powerful winches and steam windlass by Messrs. Clarke, Chapman & Co., Ltd., and Donkin's steam steering gear. Triple expansion engines, cylinders, 24 in., 38 in., and 64 in., by 42 in. stroke, with two boilers, have been fitted by Messrs. North-Eastern Marine Engineering Co., Ltd., of Wallsend. Representatives of owners, builders and engineers were on board and the trial passed off in every way satisfactorily to all concerned, a good speed being obtained.

Irmingard.—On January 23rd, the fine steel screw steamer *Irmingard* (of which we gave particulars in our January issue, page 237), built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. The Midgard Deutsche Seeverkehrs Aktiengesellschaft, of Bremen, left the Tyne for her trial trip, it being the fifth vessel built by the Northumberland Shipbuilding Co., Ltd., for this company. The machinery has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, the engines having cylinders 25 in., 41 in., and 69 in., by 48 in. stroke. Three large steel boilers 14 ft. by 10 ft. 9 in., 180 lbs. working pressure. Messrs. S. T. Taylor & Sons, of Scotswood, covered the boilers, pipes, etc., with their Tynos covering. The vessel during the period of construction has been under the supervision of Mr. G. Bahr and Mr. H. Reike. Mr. Deitrich has supervised the construction of the engines and boilers on behalf of the owners. The trial trip proved in every way satisfactory and a speed of 11 knots was easily obtained. Among the guests on board were the above-named superintendents representing the owners, Mr. J. Graham representing the builders and Mr. Harrison representing the engine builders. After the trial trip the steamer returned to the Commissioner's Spouts to load for South America.

OBITUARY.

Mr. Charles Petty, for over 13 years the highly esteemed Liverpool representative of James Walker & Co., has, we regret, passed away, after a very short illness, on January 5th.

James Dunlop.—The death took place at his residence, Motherwell, on the 20th January, of Mr. James Dunlop, of Coursington Engineering Works, Motherwell, who was an ex-Bailie of the Burgh and J.P. of the county of Lanark. Deceased, who was in his 58th year, was a native of Airdrie, and before starting the engineering business at Motherwell over 30 years ago he was foreman with the late firm of Messrs. James Goodwin & Company, now the Brandon Bridge Company, Limited, Motherwell. Mr. Dunlop's business was principally that of making steam hammers, of which branch of work few makers had a better knowledge. He introduced many improvements in their design, and at the time of his death, which came very unexpectedly, he was, in association with his son James, engaged in the perfecting of a new and improved type of hammer actuated by compressed air. Mr. Dunlop's knowledge and experience as an engineer was extensive, and his judgment in such matters was at all times received with respect. He served as arbiter in several cases when an expert knowledge such as few men possessed was necessary. His demise creates a vacancy in municipal magisterial circles which will be difficult to fill. His son James, who has the reputation of being one of the cleverest engineers in the Motherwell district, will carry on the business founded by his father, in which he served his apprenticeship, and of which he latterly acted as manager.

Tug's Long Voyage.—The steam tug *Tartar*, built somewhat over a year ago by Messrs. Scott & Sons, Bowling, and engined by Mr. James Ritchie, Glenavon Engine Works, Partick, is at present overtaking a voyage notable for its length and risks—the size and the power of the vessel considered. The *Tartar*, which is only of 110 tons register and of 450 I.H.P., was recently bought from Swansea owners for the work of towing logs on the river at Vancouver, and she left the Mumbles on December 23rd on her voyage of 16,300 miles to the latter destination. The little vessel arrived at Teneriffe on the 6th inst., and after coaling left again for Monte Video, which is 6140 miles distant from Swansea. Although in boisterous weather the run to Teneriffe was made at an average rate of something like 9 knots an hour, or 216 miles per day, a reasonably good performance for so small a craft. The *Tartar*, which will have traversed half round the globe when she reaches her destination, will proceed through the Strait of Magellan instead of taking the route round Cape Horn.

Coronel Bolognesi.—The trial trip of the cruiser *Coronel Bolognesi*, the second vessel of this type built for the Peruvian Government, affords some interesting details of the development of the scout class, or the "eyes of the fleet." The *Coronel Bolognesi* has a length of 370 feet, a breadth of 40 ft. 6 in., and a draught of 14 ft. 3 in., which will enable her to enter most of the harbours in South America. On this draught the displacement will be about 3200 tons. The machinery consists of two sets of four-cylinder triple expansion engines, each set having four cranks balanced on the Yarrow Schlick-Tweedy system. They are designed to give a collective indicated horse-power of 14,000, with a steam pressure of 250 lbs. per square inch at the engines, and 280 lbs. at the boilers. This will give a speed of 24 knots, and the coal endurance at cruising speed will be about 4,500 sea miles. The ten boilers of the small tube type are arranged in three separate water-tight compartments, and at full power will work under the closed stokehold system of forced draught. The vessel has a complete equipment of auxiliary machinery. The vessel, notwithstanding the limitations in size and cost, is effectively protected, as there extends a deck of 1½ in. thickness for the full length of the vessel, so as to cover in, not only magazines and steering gear, but also the boiler and machinery compartments. Extensive coal bunkers are arranged along the sides, in the wake of the machinery space, so as to minimise penetration by shot and shell. The conning tower forward, from within which the ship will be controlled, and fought, is constructed of nickel steel hardened armour 3 in. thick. As regards the armament, there is a 6 in. gun, with an armoured shield on the forecastle deck forward and one on the upper deck aft. The service of ammunition and projectiles to these guns has had careful consideration in order to give them the maximum rapidity. Electric motor, ammunition hoists of the dredger type have been fitted, and these are protected by armoured tubes. The secondary armament consists of eight 14-pounder quick-firing guns, and eight 1¾-pounder guns, distributed principally on the broadside, on the upper deck and bridges. There are two submerged tubes for firing 18 in. torpedoes. The cruiser has thus features which will commend her to such naval powers as Peru, where the expenditure of the navy is necessarily limited, as the vessel combines with the exceptionally high speed of 24 knots a considerable armament, including two weapons firing a 100-lb. shell at a velocity effective against unarmoured craft at three miles' range. While thus able to engage such craft, she will, with the assistance of her high speed, greatly harass armoured slower ships, and will, at the same time, create those diversions which, when practised even by relatively weak fleets, materially influence the strategic plans of a superior naval force. The vessel has also many qualities ensuring the comfort of the officers and crew in the variable climate of southern seas. She will have a total complement of 300 officers and men, and the living quarters are more comfortable than usual in such small craft. A complete system of natural and artificial ventilation has been adopted, and the ship is heated throughout by steam radiators. An electric installation supplies light for the entire ship. The captain and officers' cabins, as well as the ward room, are not only spacious, but specially comfortable. The crew are berthed under the forecastle and upper deck forward. The conveniences are notably satisfactory. This applies not only to lavatories, but to baths, etc., which are included both for the officers and the crew, those for the latter being placed amidships, on the protective deck. The vessel is also provided with refrigerating plant and ice-making machinery, with cold-storage chambers adjoining, and the bakery is equipped with mechanical dough-kneaders, etc. Again the vessel is fitted with hammock berthing instead of rails, and the stowage of the hammocks within these adds to the protection against machine gun fire, as was almost universally the case in vessels for the British Navy a few years ago. The vessel is rigged with two masts, both of which have signal yards and gaffs. There is fitted an installation of wireless telegraphy. The *Coronel Bolognesi* carries two powerful searchlights, and nine small boats will be taken, including a 34 ft. steam launch.

The Junior Institution of Engineers.—With the permission of the president of the Royal Naval College, Greenwich, Admiral Sir A. D. Fanshawe, K.C.B., and the assistance of Dr. James A. Ewing, F.R.S., Director of Naval Education, upwards of one hundred members of the Junior Institution of Engineers, on Saturday afternoon, 19th January, visited the College, and precincts. They were received in the Painted Hall by Professor J. B. Henderson, D.Sc., Mr. Henry F. V. Negus (secretary to the College), and Hon. Lieut. Thos. Pratt, R.N. (curator of Museum). After seeing the notable collection of naval pictures, etc., there, they were shown over the chapel and museum. Proceeding to the new engineering laboratories, they were met by Dr. Ewing, vice-president of the institution. All the apparatus, etc., was on view, including that used to demonstrate Dr. Hele-Shaw's Stream Lines, shown by Mr. John Smith. The laboratory is equipped on research lines and not for elementary teaching, since the engineering students have had a five years' course at Keyham College and Devonport Dockyard, on the "sandwich" system, before going to Greenwich. The course extends to one year for the average student, and to three years for the best students, who are destined later for expert work at the Admiralty or Dockyards. The equipment of the laboratory comprises a 2,000 H.P. triple expansion steam engine, ex H.M.S. *Rattlesnake*, a 45 H.P. Bellis engine and Siemen's dynamo; a 45 H.P. Parsons' turbine dynamo; a 30 H.P. de Laval turbine dynamo; a 15 H.P. Diesel oil engine; a 9 H.P. Crossley gas engine; a 12 H.P. Thornycroft petrol engine and Siemens' dynamo; a small Hornsby oil engine; a 10 H.P. air refrigerating plant; a three-stage torpedo air compressor; an 18 inch torpedo; a hydraulic pumping engine; two hydraulic motors; a Babcock and Wilcox water tube boiler; superheater, separately fired; a water softening plant; a White-Forster boiler with oil fuel; a 100 ton and 5 ton Wickstead testing machine; a complete Zeiss apparatus for the study of the microstructure of metals; a well-equipped workshop for making and repairing apparatus; a good equipment of measuring apparatus of all kinds used in experimental work. At the conclusion of the visit, the party were entertained to tea by Dr. Ewing, and on the proposal of Mr. Eade, member of council, seconded by Dr. H. S. Hele-Shaw, F.R.S., a vote of thanks was tendered for all that had been done for the reception of the Institution that afternoon.

A Benevolent Association has been recently formed in Liverpool under the auspices of patrons whose names are sufficient to ensure success in the undertaking. The name given to the association is The Liverpool Marine Engineers' and Naval Architects' Guild. The title implies that its operations are intended for local purposes, to grant assistance to those connected with marine engineering and naval architecture who have been overtaken by calamity and distress, or whose families have been left unprovided for. A large amount has already been collected in donations and subscriptions, while a circular appealing to all connected with the work of the marine engineer and naval architect has been issued. The hon. secretary is Mr. C. Nelson, 10, Drury Lane, Liverpool, and the hon. treasurer Mr. G. R. Brace, 26, African House, Water Street, Liverpool, from either of whom further details may be obtained by any of our readers who are connected with the port. The names of the patrons and members of committee are as follows:—Sir Percy E. Bates, Bart. (Messrs. Edward Bates & Sons), Arthur W. Bibby, Esq. (Messrs. Bibby Bros.), Joseph Chadwick, Esq. (Messrs. J. Chadwick & Son), Edward A. Cohan, Esq. (Messrs. H. E. Moss, & Co.), A. S. Collard, Esq. ((R. P. Houston & Co.), Sir Fortescue Flannery, Bart., D.L. (Messrs. Flannery & Given), R. D. Holt, Esq. (Messrs. Alfred Holt and Co.), Richard Henderson, Esq. (Messrs. The Anchor Line), J. Bruce Ismay, Esq. (Messrs. White Star Line), Sir A. L. Jones, K.C.M.G., J.P. ((Messrs. Elder, Dempster & Co.), Geo. H. Melly, Esq. (Messrs. Lamport & Holt), Wm. Nelson, Esq., J.P. (Messrs. H. & W. Nelson, Ltd.), The Right Hon. Lord Pirrie, P.C., LL.D. ((Messrs. Harland & Wolff) Ltd., Alfred Henry Read, Esq. (Messrs. F. H. Powell & Co.), John Rankin, Esq. (Messrs. Rankin, Gilmour & Co.), Wm. B. Sproule, Esq. (Messrs. Johnston, Sproule & Co.), Jas. H. Welsford, Esq. (Messrs. J. H. Welsford & Co.), Wm. Watson, Esq. (Messrs. The Cunard Line). General Committee: H. M. Grayson (*Chairman*), F. Adair, T. Anderson, J. Bremner, W. J. W. Bruce, G. R. Clover, J. A. Collard, W. B. Cumming, Jno. Dall, J. T. Douglas, Jno. Esplen, J. G. Evans, F. Fisher, J. A. Flockhart, J. G. Garrick, Chris. Geddes, E. C. Given, Geo. Harding, Arthur C. Hay, Geo. Hepburn, J. G. Kinghorn, G. F. Mason, Arthur J. Maginnis, F. J. Pilcher, Geo. Rollo, Jnr., H. W. L. Shubrook, C. E. Sinclair, J. B. Wilkie, A. R. T. Woods, J. D. Young. Executive Committee: F. Adair, G. R. Brace, J. Bremner, J. G. Evans, J. A. Flockhart, E. C. Given, H. M. Grayson, Geo. Harding, J. G. Kinghorn, Arthur J. Maginnis, C. Nelson, F. J. Pilcher, J. B. Wilkie, J. D. Young. Trustees: H. M. Grayson, E. C. Given, Arthur J. Maginnis. The object of the Guild is to grant relief, during good behaviour, either by pensions or donations; firstly, to deserving and necessitous members and their wives and families, and the necessitous widows and families of deceased members; secondly, to deserving and necessitous persons who have been engaged as marine engineers sailing in Liverpool-owned vessels, and (or) consulting engineers and naval architects practising in the port of Liverpool, and who have not been members of the Guild, and their wives and families; and thirdly, the necessitous widows and families of deceased marine engineers sailing in Liverpool-owned vessels, and (or) consulting engineers and naval architects practising in the port of Liverpool, who were not members of the Guild at the time of their decease. Recipients of relief from this Guild will be persons who have been engaged in the above-named businesses, or either of them, in the port of Liverpool, who through misfortune in business or incapacity by accident or decease shall have become necessitous, and widows and children of such persons; but in no case will a widow and a child of the same person receive assistance at the same time. The Executive Committee have further absolute discretion to grant relief to any deserving cases which may be brought before their notice.

Milan International Exhibition.—At the recent International Exhibition, held at Milan, Wailes, Dove & Co. (1906) Ltd., of Newcastle-on-Tyne, were awarded by the International Jury a Gold Medal and Diploma of Excellency for the exhibit of their patent "Bitumastic" Enamels, Coverings and Solution. This firm was also successful in gaining a Gold Medal and Diploma for their exhibits of the same specialities at the Genoa Exhibition held last summer. The results of these successes quite justify the large and increasing business which is being carried on by them throughout the Admiralties and the Mercantile Marine of the world. Wailes, Dove & Co's award also refers to their "Bitumastic" Solution for the protection from corrosion of structural work inland and special adaptation for all valuable plant difficult of approach and to protect. "Bitumastic" already holds against all comers the "World's Record" as an anticorrosive.

Work is now well advanced on the little fleet of yachts and motor boats being built for the 1907 season to designs by Mr. James A. Smith, M.I.N.A., of 47, Leadenhall Street, E.C. Captain Posgate's 7-ton centre-board yacht, *Will Try*, building at Mr. Olley's yard, at Strood, is now planked; she is being fitted with an experimental rig on a new principle, patented by the owner, and the steel lattice-girder mast has been completed at the works of Mr. Henry Gore, of Wenlock Street. Mr. Miall Green's new cabin river launch, *Dulcemono*, is nearly completed at Gill's yard at Rochester, and is having her Blake motor and gear installed. The 38 ft. fast cruising cabin launch, *Argolis*, has been running trials on the Thames; she has a 40-50 H.P. Blake motor, and was built by Mr. F. Maynard for Mr. S. Anargyros. She is one of the finest examples of boat building ever produced, and we hope to describe her at greater length soon. Mr. Harry Milham, Twickenham, has a smart and roomy 20 ft. yacht's launch, with a Lloyd and Plaister engine, well advanced to the order of Mr. Hill Dawe. A new 25ft. Buffalo launch has just been shipped abroad from Maynard's. The 25 ft. Clyde Class Kelvin launch is well in hand at Glasgow, and Mr. Nielsen's 48 ft. high-powered cruising launch is in progress at Christiania. The design of the 15-ton auxiliary yacht recently placed has been delayed by the serious illness of the owner, but it will be completed shortly; this yacht is to have a 30 H.P. Parsons' motor. New work since Christmas includes a 35 ft. cabin cruising design for a London owner, a 28 ft. cabin launch with two 9 H.P. Blake motors and a powerful Gardner launch set, with Meissner reversing propeller, for India. Several interesting commercial designs are also in hand.

Internal-Combustion Engines for Marine Purposes.—At the ordinary meeting of the Institution of Civil Engineers, on Tuesday, the 22nd January, Sir Alexander Kennedy, president, in the chair, the paper read was "Internal-Combustion Engines for Marine Purposes." by J. T. Milton. M. Inst. C.E. The following is an abstract of the paper :—

The author states that the economy and the increasing use of internal-combustion engines on land has led to considerable interest being taken in their application to marine purposes, and that already a large number of such engines have been fitted in small craft on the continent, in most of which heavy mineral oil is the fuel used. On land, various fuels are used for these engines, namely, petrol, refined oil, heavy oil, coal-gas, producer-gas, coke-oven gas, and blast-furnace gas, but for marine purposes generally producer-gas and heavy oil are at present the only available fuels. In the paper, however, the question of fuel is not dealt with, only the mechanism and arrangement of the engine being discussed.

It is pointed out that very large engines are in use on land, and that the experience of details necessary to make the large cylinders capable of withstanding the shocks of explosion and the high temperatures of the burning fuel will be available for marine engines, if the other necessary mechanical requirements are complied with.

The special conditions required for a successful marine engine are :—

(*a*) The engine must be reversible ;

(*b*) It must be capable of being quickly stopped, and of being quickly started, either ahead or astern ;

(*c*) It must be capable of being promptly speeded to any desired point between full speed and dead slow, which latter speed ought not to be greater than one-quarter of the full speed ;

(*d*) It must be capable of working well, not only in smooth water, but in heavy weather in a seaway in which the varying immersion of the propeller causes rapidly-changing conditions of resistance.

In large engines these conditions prohibit the use of moveable-bladed propellers, clutches, and toothed gearing, and also of a fly-wheel, and necessitate the use of a reversing engine with a direct drive on to a fixed propeller, and they require also a fairly equable turning-moment at all working-speeds.

In marine engines the revolutions are practically proportional to the speed of the ship, and as the vessel's resistance increases much more rapidly than the speed, it follows that for a reduction of speed of revolution the mean effective pressure must be reduced much more than in proportion to the revolutions. This is a much more difficult problem in marine engines, where no fly-wheel is practicable, than on land, where the use of a heavy fly-wheel permits the suppression of alternate fuel-charges.

The question of the turning-moment of the engine receives consideration. With the four-stroke cycle, where one single-acting cylinder only is employed, the fluctuation of moment varies from 7·7 times the mean moment in a forward direction to 1·5 times the mean moment in the reverse way. With two such cylinders, or with one double-acting cylinder, the motion is better, but is still unsuitable, and the minimum number of cylinders which will always give a positive turning-moment is four single-acting or two double-acting.

Diagrams are shown of the turning-moments resulting from a vertical two-cylinder tandem engine with one crank ; also of three such engines working on one crank-shaft with the cranks at equal angles, and of four such engines with cranks at equal angles, and at intermediate positions, and the inference is drawn that the arrangement with three cranks is, on the whole, preferable for marine work. Such an engine, however, working on the four-stroke cycle will not give the range of low speed necessary for marine work.

The question of carrying out the compression and expansion in separate cylinders is next considered. It is pointed out that if this is done the compression-cylinders are not subjected to the very high pressures and high temperatures produced by ignition, but, on the other hand, there is considerably more work performed in the compression-cylinders, as the gas has not only to be compressed, but also to be forced out of the cylinders. The extra work necessary for this may, however, for the most part, be returned by making the expansion-cylinder with a minimum of clearance, and arranging for the admitted charge by its pressure to force the piston some part of the stroke before ignition. By this arrangement separate compression and expansion could be arranged for without much loss of economy.

The arrangement permits of other advantages. As the clearance is minimized, there is practically no burnt gas left in the cylinder to unduly dilute the charge. The mean pressure can therefore be reduced in two ways—(1) by diluting the charge with excess of air down to the lowest firing proportion ; and (2) by throttling the supply. It may also be possible to arrange for an earlier cut-off. Altogether the arrangement will permit a much lower mean pressure to be obtained than is possible with the four-stroke cycle. Further, by admitting only compressed air suitably throttled, the engine will work at very low speeds, in the same way that a steam engine will work when throttled. An incidental advantage is the complete suppression of the two-to-one gear.

An installation which the author thinks would be suitable for marine purposes consists of an independent main engine driving the screw, having three double-acting expansion cylinders with three cranks set at equal angles. The compression is proposed to be effected by a separate engine without reversing-gear, having two sets of tandem engines, four cylinders in all, working on the four-stroke cycle driving two-stage air and gas-compressors. The compressors would deliver into storage-receivers, from which the main engine would receive its charge.

Anbotomendi.—On December 18th the new steel screw steamer *Anbotomendi* took the water at Bilbao. The boat has been built by The Compania Euskalduna de Construccion y Reparacion de Buques of Bilbao to the order of Messrs. Sota & Aznar of the same town, and is of the following dimensions :—Length, 275 ft. 3 in. by 41 ft. 7 in. beam. She has been designed to carry 3300 tons d.w. on summer freeboard, and is built to Lloyd's highest class in excess of their requirements both in hull and outfit and under special survey. She is of the well-deck type, schooner rigged, with cellular double bottom all fore and aft, and aft peak and all the latest improvements have been fitted for the rapid and economic handling of cargoes. The accommodation of captain and officers is placed on bridge deck, the engineers in bridge and the crew in forecastle. The machinery, which has been constructed by Messrs. The Wallsend Slipway and Engineering Co., Limited, at their Wallsend-on-Tyne works, consists of a set of their latest type of triple expansion engines, having cylinders 21½ in., by 34 in. by 57 in., and 39 in. stroke, steam being supplied by two large steel boilers of three furnaces each, with 3450 square feet of heating surface, working at a pressure of 180 lbs. per sq. in. The Compania Euskalduna de Construccion y Reparacion de Buques are building another boat of about 4650 tons d.w. for the same firm of Sota & Aznar, which makes the fourth boat to be built by the same builders for said firm and will be named *Udala-Mendi*.

Thorn's School of Marine Engineering.—At the Board of Trade examinations held on January 8th, 9th and 10th, the following succeeded in obtaining their Certificates as Extra First-class Engineers :—Mr. R. A. Holmes at North Shields, and Mr. J. H. Morgan at Glasgow. Both passed the first time of going up, and were prepared by Messrs. Thorn's system of Postal Tuition. They were also the only successful candidates at the ports mentioned. At a special examination, held December 12th to 15th inclusive, at the head office of the Board of Trade (Marine Department), London, a member of the Royal Indian Marine qualified as Government Surveyor under that body, making the seventh successful candidate for this position (all passing the first time up) from this school. These were prepared by W. H. Thorn & Son, 5, Waterville Terrace, North Shields, from which establishment 147 Extra First, 28 Surveyors, and over 6,800 ordinary candidates have passed

Messrs. William McGeoch & Co., Limited, inform us of the fact that after January 3rd their business was conducted from their spacious new premises, the main entrance of which is at 28, West Campbell Street, Glasgow.

The Hunslet Engine Company, Limited, of Leeds, advise us that they have appointed as their sole London representatives Messrs. J. E. Lawler & Muirhead, of 39, Lime Street, E.C.

REVIEWS.

Ancient and Modern Ships : Part I., Wooden Sailing Ships ; Part II., the Era of Steam, Iron and Steel. By Sir George C. V. Holmes, K.C.V.O., C.B. London : Wyman's, 1906.

THE author of the volumes before us has had exceptional opportunities during the many years in which he was secretary of the Institution of Naval Architects, to study the subject with which he deals, and no one can peruse the book without being assured that he has made good use of his opportunities. But in criticising the work, we must not lose sight of the fact that it does not pretend to be exhaustive. It is written at the desire of the Board of Education, with a special object, that of assisting the student at the Victoria and Albert Museum. The first volume gives us such details as are known of the ships of the ancient world, Egyptian, Persian and Assyrian, going on to those of the Greeks and Romans, who, it will be remembered, had ships of considerable size, not only for military purposes, but also for the carriage of grain from Egyptian ports to Italy. Great pains have been taken to secure the best possible explanations of the difficult question as to how the multibanked galleys of the ancients were arranged and managed. Whilst we are brought through the middle ages to the ships which in Elizabethan and subsequent eras built up for us the British Empire, the first volume concludes with notes on the famous clipper ships, whose names are still household words amongst those who follow the sea, and whose great deeds kept up the sailing vessel's record until the steamship was already well established.

The second volume deals with more modern times. A brief summary of the historical facts connected with the introduction of steamers, illustrated by some excellent plates of early vessels, is followed by a description of the modern passenger ship. There can be little, of course, new to our readers here, though it will be of interest to many of them to have the facts assembled for their use. Then comes a valuable chapter on the development of the special types of ships in which recent years have been so fruitful. Something is said about the turret decked ship and the steam tanker, whilst the different modes of construction are explained and illustrated. Appendices afford some introduction to a few of the mathematical problems which confront the ship designer, and also explain what is meant by tonnage as applied to warships and merchant vessels.

The hurried sketch we have given will show our readers that Sir George Holmes has admirably fulfilled the object placed before him and has assembled almost all the known facts relating to the ships of antiquity. He very properly acknowledges the fact that the writings of the late Mr. Lindsay and others have been drawn upon for material and for illustrations in regard to the earlier periods. But it will be acknowledged by everyone conversant with the subject that it is the knowledge and discrimination which he has been able to bring to bear on the materials before him, which have made the book the undoubted success which it is.

The Theory of the Steam Turbine. By Alex. Jude. London : C. Griffin & Co., Ltd. 1906.

THE author says very truly that steam turbines have not had that study from a theoretical standpoint that has been devoted to reciprocating engines from the very nature of things, and that he essays to do this and possibly prevent inventors and others from straying in wrong paths and devising engines which are either impossible or impracticable. This will be allowed to be a high standard to take up, it being put forth that turbines for steam and water are totally different, and that rules cannot be educed from the latter that will apply to the former. The author proceeds at first to give the fundamental basis of the subject and to form a structure on which his edifice shall rest hereafter. For this purpose he gives us numbered theorums which he derives from standard works on hydraulics and hydro-mechanics, and he illustrates these and treats the matter in sound scholarly fashion, leading the reader up to what are the characteristics of reaction and impulse turbines. We then, as is natural, find a history of the subject with a review of what has been achieved by successive inventors, the type and diagrams as throughout the book being of the best. As the velocity of steam is an important feature of turbine work, the author rightly gives a prominent place to this branch of study, and we have the theory of the matter adequately treated both for dry saturated and superheated steam. Another point discussed as of great importance is the size and shape of the nozzle to give the best results.

In coming to the actual turbine machines themselves, we do not find here merely a more or less correct description of each type, as makers will generally furnish, but the author classifies the principles underlying the matter and the reader can see for himself what a reaction machine is, followed by the impulse type and variations, such as a graduated pressure machine, a velocity turbine and a combination of both. The first of these last three is described as compounding for pressure, the second as compounding for velocity, and the third as bearing a resemblance to the compound or triple expansion engine, the turbine being divided up into two or more cylinders. The Parsons system is described as a mixed impulse and reaction machine. The author gives us the reasons for the adoption of the types we most generally know, and we there find that erosion of the vanes is one evil to be contended with. Photos are given of this action of steam on suitals, and at this stage conclusions are drawn as to the type of machine that is likely to survive. With the principles so thoroughly gone into we next have machines themselves, and by this time the makes of leading names like De Laval, Riedler-Stumpf, Reatean, Zoellez and Curtis before coming to Parsons, are all tolerably familiar to the public. We can only say that the drawings and and particulars of their machines as found here are of the very best, and any engineer can follow the details readily. There are other makers besides those we have named, which shows there is no lack of workers in this field. The author is enabled to give us the efficiency of compound turbines, and points to errors introduced by practical considerations. The shape of the vane and the trajectory of the steam are fully discussed, and we see the advantages and otherwise of increasing the number of stages in a turbine beyond a certain point. The author gives close calculations for the various passages that the steam goes through, but, as he says, a large number of these are quite unnecessary in practice if the principles be properly understood. The history of the turbine is incomplete without mention of the successive stages that vanes have taken in the progress of the subject. A chapter is devoted too to governing alone. This may be throttling, variable admission or periodical admission, such as in the Parsons machine. The methods of doing this are clearly shown. As a discussion upon turbines should include the mention of vacuum we note it is properly introduced here, and it is seen that the turbine is not burdened with the alternate hot and cold temperatures as an engine is, and it can therefore benefit by complete expansion, and the back pressure. Other reasons tending to the same result are found here, with diagrams in illustration. Parsons' vacuum augmentor is shown in this connection. The effect of superheat on both classes of machine is noticed and the difficulties connected with the generating and measuring superheat. Some mention is made of marine turbines at the end, and the rule that governs them. Sufficient has been said by us, we think, to make it clear that we have here what is probably the standard book on this subejct, up to the present time. The author endeavours to reduce to rule the laws that operate in design, and this is what, perhaps, no previous writer has been enabled to do. Few have had the practical experience necessary and if they have this the theoretical training is lacking to be able to reduce to writing their views and so advance the subject at all. The author does this all. He is evidently at home with some of the types he discusses, and the others he can, therefore, make himself familiar with. There are few outside sources drawn upon by him, and the claim set up in the preface appears to us justified as far as the high standard of the book is concerned.

A Handbook for Steam Users. By M. Powis Bale. London : Longman, Green & Co., 1906.

THIS is the fifth edition of this little work, which is an embodiment of directions to engine and boiler attendants which should prove of considerable value to those for whom it is written. These commence with filling the boiler, lighting the fire and go on through the various stages of examinations of details, such as safety valves, bearings and pumps. Starting and the working of different classes of engines is followed

by shutting down and banking fires. In the management of boilers, attention is paid to the details, such as low water alarms, feeding the boiler, feed water heaters and filters, while the question of incrustation and remedies is not passed over without mention. Water gauges, fusible plugs, boiler covering, priming and plugging leaky tubes are some of the points noticed. Repairing a boiler is a large subject, but it is one that is gone into here, with regard to engines knocking, and the setting of slide valves find a place, while packings and making joints with the rules for calculating horse-power are leading features. The causes of boiler explosions make up a chapter, while another is upon Corby's or Trip gear for engines with their advantages and drawbacks. There is an account of how to set a boiler and some calculations which may be of service to engine and boiler attendants. Simple as these rules all are it is to be readily understood how they are appreciated both by owners and men employed in charge of engines and boilers.

Time Tables. By Thos. Reader. London: Longman, Green & Co. 1906.

THIS is the 5th edition of this important little work for facilitating interest and discount calculations. It comprises tables for every day in the year, and it is possible to obtain at a glance interest for any period by finding the number of intervening days from the table. Or again, given the number of days we can see when a bill falls due, other calculations of this character are possible as, for instance, in making up pension lists and generally assisting those charged with making pay returns where the number of days elapsed is required for assistance in the reckoning.

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The Marine Engineer

And Naval Architect.

LONDON, MARCH 1, 1907.

THERE has been much general discussion as to the applicability of Gas Propulsion to Marine Service, and we welcome a considerably long and ably digested paper on Marine Gas Propulsion in relation to Imperial Commerce and Defence read by Mr. A. Vennell Coster, before the Manchester Association of Engineers. This paper covers a wide subject and is of great length, as it particularly deals with the various degrees of efficiency of coal with steam, as compared with coal from which gas is produced, and the gas utilized in suitable gas engines, the difficulties attending the application of gas engines to marine work, instances of special gas engines applied to Marine Propulsion, and finally the value in the Navy of engines which will be without visible smoke.

Now to give some details of the subjects of this paper. We are quite interested in the various comparative drawings in which the left-hand vertical line shows the whole value of the coal either supplied to the boiler in a Marine Steam Turbine Plant, or a Marine Reciprocating Steam Engine Plant, or in the Marine Gas Engine Plant, this same line showing the value of the coal which is supplied to the producer. From these equal commencements are shown, in four successive columns, the gradual loss as between boiler and engine, of the percentage of heat allowed to pass away, and in the case of the marine gas engine plant, as between the producer and the engine, and the effective gain in the engine from the gas supplied to it. The final column shows 13% work utilized in the steam turbine as against 11% in the older reciprocating plant, and as compared with 23·8% in the gas engine plant. We understand that such eminent authorities as Captain Sankey and Mr. A. Basil Wilson have examined and approved these respective columns, and that they agree with data given by Mr. J. E. Thornycroft. These respective charts give excellent reasons for the adoption of gas engine plants for marine purposes where there is double the efficiency as regards effective work per coal carried, in favour of the gas engine, as compared with the old reciprocating engines, if such a gas plant can be accommodated on board. It must be remembered that beyond the ship being driven with half the fuel there are other side advantages connected with the marine gas plant. Stand-by losses are reduced over 75%. The working pressure is confined to the engine cylinders. There are no boilers or main pipes to burst, or furnace crowns to collapse. There is no priming in a heavy sea-way, and no water hammer in pipes and cylinders. There are no more difficulties with the firing of boilers in a beam sea. But as to what may be put down as the other side of the question: What about gas leakage and consequent asphyxiation? Well, it must be remembered that this risk is taken in very many land places, and it must be remembered that a boat at sea is in the best possible position to keep her bowels cool and clear if this essential point is recognised. What about the variations in gas valves and the sticking of valves, causing the unreliabity of the engines in working? It is brought forward that the former has been quite overcome by higher compression and adjustable double electric ignition. Then comes the difficulty of reversing. For small powers a reversible propeller is of excellent service; where the power amounts to and is above 500 H.P., probably the engines must be themselves made to reverse, and many methods of doing this are at present extant. Mr. Cherry has several designs for this purpose, whilst Messrs. Crossley & Thornycroft rotate the cam shaft of their gas engines for marine purposes. There is much more in this paper than we can here detail, but we find it excellent reading for all those who are desirous of looking into this matter.

Before the North-East Coast Institution of Engineers and Shipbuilders, a paper has just been read by Mr. F. H. Alexander, on a suggested method for experiments on the wind resistance of ships, and we think that shipowners ought to be able to make themselves assured as to the peculiarities of modern steamer build, as regards their actual resistance to a head wind, or even if the wind is blowing considerably on the port or starboard bow. The apparatus suggested by Mr. Alexander need only cost about £120, but if the apparatus were bigger more valuable results might be attained, up to a price of say £300. The apparatus suggested consists of a principal member which is under water and floated at the end with a water-tight tank, and which enters upwards within the body of the model, which is built to present to the wind exactly such forms as correspond to any vessel which it is desired to test. The upper end of this principal member is attached to transverse breakwater spars, which are diagonally stayed to the upper end of the central member. On either side are also two pairs of breakwater spars held by guy ropes to the head of the central member. The front end of the main member has two water-tight tanks, and this whole apparatus serves to protect the model from rough water. The recording apparatus is a Lander's wind speed recorder and a resistance or pressure recorder which may indicate the extension of a spring. The indicating chart is on a sheet of paper which is secured to a time-revolving drum. The records are traced upon the sheet on the drums,

starting from a zero line of wind speed or pressure. A time record can be obtained on the drum in the usual manner. The necessary adjustments of drum tracers and clockwork having been made, the apparatus is left to itself to record the variations of wind speed and pressure, provided the particular case of the wind exists. The floating frame and the ship swing head to wind, no matter what may be the direction of the wind. In order to check the drum from revolving when there is no wind, or so slight as to give no practical results, a pawl attachment is provided to stop the clockwork unless the pressure exceeds a certain value. If it is desired to test the wind on a port or starboard bow, a bridle to the moving cable is provided that can be used to steer the floating framework and the vessel round to the desired angle. We trust that many shipowners will at once see the importance as to the valuable results that may be attained by this apparatus.

THE paper read at Newcastle by Mr. J. Denholm Young on the training of cadets for the mercantile marine calls attention to a subject which has been growing more important each year, and a letter published in our present issue—held over for some time by reason of more pressing matter—also bears upon the solution of a question of great interest to everyone whose business lies upon the waters or calls them to cross the deep. Mr. Aukland views the departure of the sailing ship with the eyes of one who considers that an excellent training ground for the sailor is fast slipping away, and many will agree with him on his own arguments. The romance of sea life has been greatly shattered since the days when Dibdin sang and created the enthusiasm which led to home desertion for the forecastle, with the quarter-deck in visions of the future. To those whose sympathies are with the sailing ship training, the apprentice on the merchantman or on the training ship specially fitted out for the purpose will appeal as the best source of supply for the junior deck officer. On the other hand, with the disappearance of the sailing ship, this source of supply is straitened, while the steamer is becoming more and more complete, and the deck machinery more multiplied, thus inviting—if not demanding—paramount attention to the mechanical arts and crafts by all on board, especially the directing officer, who should therefore undergo some training which will enable him to take an intelligent interest in, and exercise a judicious supervision over, the constructional details of the ship and the machinery more immediately under his working control. The views advocated in the paper by Mr. Young are in the direction thus indicated by the claims of the present-day steamship.

LORD PIRRIE.

IT has frequently been remarked that the Institute of Marine Engineers has been singularly apt in its choice of Presidents, and it has been no less fortunate during the session now drawing to a close. This month we have pleasure in giving to our readers a portrait of the retiring President, whose creation to the Peerage with the title of Baron Pirrie of Belfast occurred during his year of office. Lord Pirrie began his travels across the ocean very early in life, having, on the death of his father, sailed from Quebec when about a year old, accompanied by his mother, to Ireland, where, at the home of his grandfather, he was brought up. His schooling as a lad was received at the Royal Academical Institution, Belfast, where he proved an industrious student, excelling in his classes, especially in mathematics, a study invaluable to the engineer and shipbuilder. On the completion of his school life he entered the works as an apprentice where now he holds sway as the principal. His energy and push, combined with steady application and natural ability, brought the youth to the attention of the heads of the firm, and after he had been about twelve years in the employment of Messrs. Harland & Wolff, he was admitted into the inner circle. Shortly after his admission as a partner, the seniors, Sir Edward Harland and Mr. Wolff, devoted themselves more to the service of the nation in political life, thus leaving greater responsibility upon the juniors. The practical experience gained by Lord Pirrie during his apprenticeship, and that carried through in the proper style, starting at 6 a.m., followed by his subsequent training, brought out those inherent qualities which afterwards developed and justified the foresight of Sir Edward Harland in entrusting the management of the works to his junior. The behaviour of steamers at sea under different conditions of weather is a part of the training of an engineer and shipbuilder which Lord Pirrie has given attention to, having made observational voyages across the seas to study this part of his business, as shipbuilder. The results of his design and labour are witnessed in the magnificent steamers of the White Star Line and others, which have brought the firm, as well as the city of Belfast, into foremost places for the historian of the generation to enlarge upon with ample materials full of interest and of incident to show that the spirit of enterprise has been very much in evidence on the banks of the Lagan, while the directing hand has not been confined to rearing a substantial shipbuilding and engineering establishment amid a waste of mud, but has been helpful all round in erecting buildings and institutions to beautify and adorn the land, as well as to evoke the blessings of suffering humanity.

In social and benevolent work Lady Pirrie has proved not only liberal, but tactful, in seconding the plans of her husband for the good of Belfast and its people. During his two years of office as Lord Mayor, Lord Pirrie was instrumental in advancing the city in all its directions of progress, while at the same time the industrial operations of his firm were becoming more and more advanced, increasing the output of tonnage in larger hulls and in the aggregate for the year, until the former reached the proportions of the *Oceanic* of 28,500 tons displacement—advancing over that of the standard set by the Great Eastern by about 3500 tons; and the output for the record year reached a total of 110,000 tons. The total number of hands employed by Messrs. Harland & Wolff is about 10,000, and the amount in wages per week about £16,000. In recognition of the enormous gain to the country represented by these figures and the able personality which has brought them into being, the Royal University of Ireland conferred upon Lord Pirrie the degree of LL.D., and the University of Dublin (Trinity College) the degree of D.Sc. During his year of office as President of the Institute of Marine Engineers the progress which has been a prominent feature in connection with all his other undertakings has been no less manifest, and in closing our necessarily brief reference we wish Lord and Lady Pirrie many long years of health and happiness.

Photo by Lafayette, Ltd., London.

The Right Hon. Lord Pirrie.

THE SCREW PROPELLER.

VIII.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

RANKINE'S own statement of the theory of the propeller is as follows:—

"*The fundamental principle of the action of every propeller is the same, whether it is an oar, a paddle, a screw, a jet, or any other contrivance. The propeller drives backward a certain quantity of water with a force depending on the quantity of water driven back and the speed impressed upon it. The water presses forward against the propeller with an equal force, and that force (which is called the reaction of the water), being transmitted to the framework of the machinery, and thence to the vessel, is what drives her forward. When the ship is starting from a state of rest, or increasing her speed, the driving force must be greater than the resistance; but so long as the speed is uniform the driving force and the resistance are equal.*"

"*Some propellers act directly backwards on the water, or nearly so, like the feathering paddle: . . . some, like the screw, act obliquely in various directions.*"

The Speed of a Screw is the pitch multiplied by the revolutions made by it in a unit of time, say one minute or one second.

Apparent Slip.—The difference between the speed of the screw and the space moved through by the ship in the same time is called the apparent slip.

Real Slip is the mean velocity imparted by the screw to the column of water through which it has passed.

An Ideal Screw should impart to a column of water of its own diameter, and of a length equal to pitch multiplied by revolutions, a velocity equal to its own speed, *minus* the speed of the ship, so that the real slip and the apparent slip are then identical.

Putting these matters algebraically:

Let V be the speed of the screw per minute.

v the speed of the ship in ft. per minute.
D the diameter of the screw in ft.
P the pitch „ „ „
R the revolutions per minute.
S the apparent slip in feet = V—v.
s the real slip = fS.
A the area of the real stream.
M the mass of a cubic foot of water.
W the weight of a cubic feet of water, or 64 lbs. for sea water.
g the accelerating force of gravity taken at 32.
T the thrust in pounds.
Mass M = W ÷ g.
Momentum = M × Velocity (per second).

Momentum per cubic foot:

$$= \frac{W}{g} \times \frac{S}{60} = \frac{64}{32} \times \frac{S}{60} = \frac{S}{30} \text{ pounds.}$$

The ideal column of water passed in cubic feet per second of time $= \frac{\pi D^2}{4} \times V \div 60$

The thrust due to this $= \frac{\pi D^2 V}{240} \times \frac{S}{30}$ lbs.

$$= \frac{D^2 \times V \times S}{2290} \text{ lbs.}$$

This thrust, multiplied by the space through which the thrust block (that is the ship) passes *in a minute*, and dividing the product by 33,000, gives the horse power exerted by the screw.

For example, suppose a ship to have a screw 10 ft. diameter, 15 ft. pitch, revolving at 100 revolutions per minute, giving a speed of screw of 25 ft. per second, or 1500 per minute, and the ship moves 1200 ft. per minute, or at the rate of 12·85 knots per hour.

The apparent slip is 1500 − 1200 = 300 ft. per minute, or 5 ft. per second.

The slip per cent. is (300 ÷ 1500) × 100 = 20.

The column of water per second will be 78·5 × 25 = 1962 cub. ft.

Then the thrust $= \frac{1962 \times 64}{32} \times 5 = 19620$ lbs.

Or taking the above formula:

$$T = \frac{10^2 \times 1500 \times 300}{2290} = 19620 \text{ lbs.}$$

Then the horse power $= \frac{19620 \times 1200}{33000} = 713{\cdot}5$

If the efficiency is 0·7, then

I.H.P. = 1019

The Real Screw of every-day practice behaves in quite a different way from the ideal. In moving through the water it makes disturbance, first by the edge resistance of the blades; secondly, by the friction of its surface, causing some of the water to be dragged along with it, and that water imparting

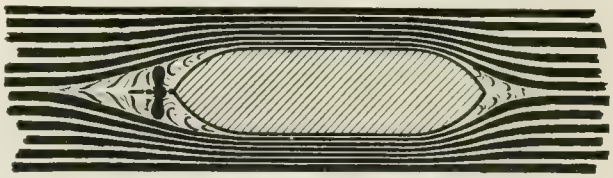


Fig. 19.

motion to the water with which it is in contact; and thirdly, by the various directions in which the water is set in motion, due to the obliquity of the blades. There is a further and important disturbing influence on the action of the screw in practice, but that is caused by the ship, or rather it is due to the shape of the ship preceding the screw; and is especially intense with the ordinary single screw ship. It is very interesting and instructive to watch the action and movements of the stream of water flowing past any ordinary sailing ship when at anchor in a tideway, especially those streams at or near the stern. If the tide is running strong, and the "run" or stern lines of the ship are "full" it will be observed, fig. 19, that the streams on either side do not meet at the stern post, or even at the rudder end, but some way astern of the ship, and in the triangular space thus formed there is virtually still water, that is water which remains and is not carried away with the surrounding water; there will be also continual eddies and occasional whirlpools on the slightest movement of the ship. It will also be seen that the water in changing direction of flow, parallel to the ship to converge astern of it, tends to form a difference in level or a slight wave. If on the other hand the ship is "fine" aft, and has a "good run," and the tide is

* For Articles I. to VII. see August to February issues.

not very strong, the two streams converge gently at stern, and there is little disturbance of any kind.

A further practical study may be made by watching a square-ended log anchored in a strong tide, there is then a most pronounced triangular space between its end and the converging streams, into which water flows from abaft it in the opposite direction of the tide to fill the depression so made. This takes place on a large scale with ships when moved at a higher speed than their lines are suited for, and was very observable in the early days when so many ships in H.M. Navy, which had been designed and built for sailing ships, were converted into screw steamers. Not all such ships proved so bad as H.M.S. *Dauntless*, for some of them were of the "cod's-head and mackerel tail" form, so much upheld by some of the old navigators and derided by others. The fine run, however, has been recognised by all steam-ship designers since, as being as necessary to efficiency of propeller as it is to minimising the resistance of the ship. The following shows the import effect of a comparatively small difference in form of the stern.

The *Dauntless* was looked on in her day as a smart frigate, and was one of those chosen so early as 1847 to be fitted with a screw propeller. The customary gap was made in the dead wood and an inner stern post fitted and everything done to accommodate the 14·7 ft. diameter screw; her engines, which were horizontal geared ones of 580 n.h.p., having two cylinders 84 ins. diameter and 4 ft. stroke, made by the then famous firm of R. Napier & Sons, were expected to drive her at a rate of at least 10 knots per hour. She was completed and tried in Stokes Bay in 1848, with most disappointing results, as the best she could do was less than 7½ knots, a most absurd speed for a pair of 84-in. cylinders in so small a ship. The slip per cent. was 21·82, which was not very high for the screw of the period, although we know now it was higher than was warranted by so large a diameter and surface.

The thrust as calculated is only 12,860 lbs., and the effective horse power of the screw 291. The authorities at that time rightly divined the cause of failure and, without too much theorising and debating, proceeded to fit the ship with a new stern, whereby her length between perpendiculars was increased by 9·5 ft., and her lines improved. She was again tried in Stokes Bay, in 1850, when with the same screw and machinery a speed of 10·016 knots was obtained, and although the power developed was largely in excess of that on the original trial it was not proportionally so, for under the altered conditions she could do the 7·366 knots with only 352 I.H.P., or little more than the output of the screw before alterations, and less than half the I.H.P. developed on that occasion. With a slight increase in the pitch of the screw a trifle better speed was obtained with less I.H.P. But even then, although the improvement was great over the original trial, the result was poor compared with the performance of a modern steel steamer of the same displacement and co-efficient of fineness, as may be seen by referring to the last column of the accompanying table.

In the case of the bluff-ended ship moving at high velocity, fig. 19, there is a loss of efficiency quite as serious and nearly as great as that due to the imperfect action of the propeller, namely, the absence of water pressure at the stern. The effect of this is easily perceived by imagining what would happen to a log floating in still water, and having applied to one end of it a flexible bag, secured independently of the log, so as to remove the pressure from that end. The water pressure over the other end would put the log in motion in a direction to compress the bag. An analogous effect is produced on a ship when she is moved through the water at a sufficiently high rate to prevent the inflow maintaining a head of water at the stern. There is in every screw steamer a loss due to this cause, and the larger the screw the greater it will be, inasmnch as the equivalent of the above-named bag is greater. On the other hand the screw must always be of such a size as to enable it to reach and operate on a sufficiently large quantity of water.

Table XII.

	H.M.S. "Dauntless."			S.S. "Z." (Modern)
Date	1848	1850	1850	1896
Length, Perpendiculars ft.	210·0	219·5	219·5	250·0
Breadth, Extreme.....ft.	39·75	39·75	39·75	30·0
Draught of Water, Mean. ft.	16·33	16·6	16·33	16·0
Prismatic Coefficient	0·723	0·700	0·708	0·700
Immersed Mid-Sect'n sq.ft.	532	520	532	455
Displacement .....tons	2307	2235	2307	2270
Wetted Skin.....sq. ft.	11,934	12,068	12,136	12,960
Screw Propeller Diam....ft.	14·73	14·73	14·73	12·5
Do. do. Pitch ...ft.	16·8	16·8	17·72	14·8
Revolutions	56·9	71·7	68·28	77·0
Slip per Cent.....	21·82	15·63	13·73	12·28
Speed.....knots	7·366	10·016	10·293	10·0
Indicated Horse Power ...	836	1388	1217	685
Displc'nt.$^{\frac{2}{3}}$ × Speed^{3} ÷ I.H.P..	83·4	123·7	156·5	253
Indicated Thrust, gross lbs.	27,588	38,170	33,050	19,760
Do. do. net lbs.	19,338	29,920	24,700	17,784
Propeller Thrust, calculated .....lbs.	12,860	18,420	17,680	13,575
Resistance of Ship, net calculated .....lbs.	8378	15,688	16,629	12,960
Do. do. ÷ Gross Indicated Thrust	0·304	0·411	0·503	0·656
Do. do. ÷ Net Indicated Thrust	0·433	0·525	0·674	0·735
Propeller Thrust ÷ Net Indicated Thrust	0·666	0·616	0·716	0·763

Institution of Naval Architects.—The annual meetings of this Institution will take place on Wednesday, March 20th, and the two following days, in the Hall of the Society of Arts, John Street, Adelphi, W.C. (by kind permission of the Council). The Right Hon. the Earl of Glasgow, G.C.M.G., LL.D., President, will occupy the chair. The annual dinner will be given on Wednesday, March 20, in the Grand Hall, Hotel Cecil, Strand, W.C., at 7.30 p.m. It is proposed this year to hold a Summer Meeting at Bordeaux, on June 25th and the following days, jointly with the Association Technique Maritime, in connection with the Bordeaux Maritime Exhibition that is to be held in that city. Details of the proposed meeting will be announced in due course.

THE FLEETS OF THE MAIL LINES.

(From our own Correspondent.)

The National Steamship Company.

THE Journal of Commerce of the 16th February, 1907, contained formal announcements to the effect that the steamships *America* and *Europe*, heretofore owned by the National Steamship Company, having been acquired by the Atlantic Transport Line, would, in future, be known as the *Memphis* and the *Mobile* respectively.

This announcement seems to mark a step in the fate of the old National Line, which, founded soon after the close of the American Civil War, did exceedingly well for a few years. It built a fleet of what in the old days were fine steamships of the mixed passenger and cargo type, culminating in the large vessels *Spain* and *Egypt*, which it added to its fleet in the year 1871. They were vessels of quite a fair turn of speed for their day, and were of the great size of 4500 tons gross register. The fleet comprised over a dozen big ships, some of which had been lengthened what time they had been brought up to date by the introduction of the compound engine. The Company indeed was well to the fore in improvements, for I believe that their steamship *Italy* was one of the first, if not the actual first, to sail in the New York trade with the compound engine. Then came a period of depression and inactivity. Services were maintained from both the Mersey and the Thames towards New York, but not much money was made in the business, and repairs and renewals could not be kept up to date. But in the early eighties came a boom and a good sum of money was found in the Company's coffers. So the management went in for an ambitious programme. The *Alaska* was showing what an attraction high speed appeared to the passengers of those days, and so the Board of the National Company determined to have a greyhound too. They ordered the *America* from Clydebank, trusting that the good times which had recently favoured them would continue and that they would have enough to pay her full cost. Delivery of the flyer came in due course. But she proved rather a white elephant to her owners. One swallow does not make a summer, and a single express boat will not make a passenger trade. People like to book by a line which gives them the advantage of return fares, and frequent opportunities of sailing homewards. This the single ship could not do. Then there was an attempt to run her during the summer months in a fortnightly service with the *City of Rome*. Finally the Italian Government took the ship over, and the dream of a passenger service was at an end. The older ships meanwhile were being lost or broken up, whilst in 1890 a less ambitious *America* from the East Coast and a sister the *Europe* were added to the fleet. Then came the connection with the Atlantic Transport Line, which had taken a large interest in the shares of the Company.

In 1895 the Company was reorganised, the Liverpool office was closed, as indeed was that at New York; the New York Pier, which was commodious and valuable, was let and a steamship named the *Michigan* purchased. Subsequently a large twin-screw liner, the *Manhattan*, was built for the line by Messrs. Harland & Wolff. This ship and a new *Michigan* are all the steamships now left to the Company, which seems to have become a small side-show of the Atlantic Transport Line. Those shareholders who refused the suggestions to wind the Company up altogether at the time of the reorganization, must be sorry that they succeeded in getting their views carried out. The management of the Atlantic Transport Company at all events seem to have tried their best to revivify the business, but the dead weight was too much for any one to lift.

Disasters.

Two somewhat sensational disasters have to be chronicled. The earlier of the two was the loss of the American paddler *Larchmont* by collision with a schooner off Rhode Island on the morning of the 12th February. The colliding vessel seems to have been unable to render any assistance, and the wooden hull of the *Larchmont* was so torn by the impact that she quickly foundered. Nineteen persons only survived from about 170 passengers and crew. The proportion of crew amongst the saved is somewhat high, and for that reason comment has been made upon the crew's conduct. But it should not be forgotten that seafaring persons are more inured than ordinary folk to the severity of the elements, and were thus more likely to survive the terrible expriences which befell them. Many of the dead were found to be cased in ice. It is altogether a ghastly story. It may be well, however, not to stifle it, as it seems to show once more how superficial and useless is the alleged official inspection of life-saving appliances in some, at least, of the river and coasting craft of the United States.

Then came the loss by collision of the steam collier *Orianda* off the Nash Point. The colliding vessel here was the fine new steamship *Heliopolis*, of London, which sustained damage and had enough to do apparently to look after herself. The *Orianda* sank very rapidly, and all the nineteen men of her crew were flung into the cold and storm-tossed waters. Mr. Bevan, the third engineer, came up near a water-logged lifeboat and was enabled to get into it and eventually to help his chief, Mr. Aitken, and four foreign seamen into this comparative safety. But the gale blew the boat away. However, by good luck a Barry pilot boat came along and succeeded in taking three foreign seamen out of the boat. They then lost her. Then she drifted alongside the Norwegian steamship *Ebba* inward bound to Cardiff. By this time the three men remaining on board were numbed with exhaustion, and could do nothing to help themselves. The Norwegian skipper accordingly had himself lowered into the boat, and sent up the three helpless forms at great personal risk. The foreign seaman was found to be already dead, but the two engineers were fortunately in a condition to be brought round again.

The sailing vessel *Theodor* is at last posted as missing. In her disappears one of the most famous vessels of the fleets of the Mail Lines, for as the *China* built by Robert Napier & Sons in 1862, she was the first of the iron screw mail steamers of the Cunard Line. In the sixties her name was a household word in Liverpool and New York. After serving her owners well for a number of years she was transferred to the Compania Transatlantica of Barcelona, and finally made a sailing vessel. For some time she flew the German flag, but at the last was transferred to Norwegian owners. On this final voyage she shipped a cargo of phosphate at Tampa and sailed on the 2nd March, 1906, for Yokohama. There was a report that she was spoken subsequently in the Atlantic, but there seems to be some possibility of doubt as to the identity of the ship which was believed to have been her. This, it should be remarked, is not the first time she has been in the overdue list, as two years earlier she made the exceptionally long passage round the Horn. This time, however, there seems little hope of her safety.

The Loss of the Berlin.

The deplorable catastrophe which took place on the morning of the 21st February at the Hook of Holland reminds one of the fact that, even in these modern days when science and art have combined to render ships stronger and more seaworthy than they have ever been, the sea is still master when it is really aroused. The *Berlin* was one of three sisters built for the Great Eastern Company by Messrs. Earle's, of Hull, in 1894. These vessels were the *Berlin*, *Vienna* and *Amsterdam*, all with twin screws, and of just under 1800 tons gross register. The *Colchester*, launched in the previous year, was a couple of feet smaller both in length and in beam. It is too soon to form theories as to the reason that the vessel took the ground—probably it was really stress of weather. The coast is always a dangerous one, and it is appalling to think how quickly the strongest ship is pounded to pieces on those cruel sands. The Great Eastern Railway has always been so successful in the management of its fleet that it will have widespread sympathy in this its first serious disaster. The narrow seas have seen many shipwrecks, though those of cross-channel vessels have of late happily been rare in comparison with the large number of services maintained in all weathers and in every direction. What the gale must have been is evidenced by the troubles of the Irish mail trains, which were brought to a standstill for want of water for the boilers of their locomotives, the wind blowing the water out of the running troughs before the scoops of the tenders could pick it up, whilst one of these trains was brought down to a speed of four miles an hour by the violence of the blast! When such things befall trains can one wonder that disasters happen at sea?

The Hamburg-America Line

is certainly a marvellously successful organization. One imagined that the year 1905 would be quite an exceptional year, the profits being swollen by the results of the Company's operations in connection with the Russo-Japanese War. The results of 1906 do not, in truth, turn out quite so well as those of its predecessor, but they are sufficiently satisfactory. The earnings of the Company amount to very nearly twenty-five per cent. on the amount of capital, bonds and shares combined. Out of this £1,050,000 is carried to reserve and a dividend of 10 per cent. for the year distributed amongst the shareholders. Comparing 1906 with 1905 we find that there is only a diminution of one per cent. in the dividend, with a lessening of the amount carried to reserve by £175,000.

Fleets.

Some very interesting statistics regarding the immense volume of the Hamburg-American Company's business have been published. In the year 1906 crews for some 435 vessels were signed on, the total amounting to over 26,000 officers and men. At the close of the year the fleet in being comprised 150 vessels, of 740,000 tons in all, whilst another eight steamships of 90,000 tons were under construction. The great mean size of the new construction is remarkable, whilst it will be noticed that the tonnage of this single fleet of German ship-owners is rapidly approaching in size the whole steam mercantile marine of France, one of the greatest maritime countries.

The Nord Deutschser Lloyd

celebrated its Jubilee on the 20th February. It too has increased enormously in strength during recent years, especially since it began to adopt the twin-screw system for its mail and passenger services. In a few weeks it will have the four fastest liners—save perhaps the Hamburg Line's *Deutschland*—on the Atlantic, though the blue riband will doubtless be taken from it when the new Cunarders come on the scene.

The Blacksod Bay Route.

Journalists and promoters do not seem to pay much attention to the teachings of history, or the memory of that colossal fiasco, the old Galway line, would surely deter people from proposing such an enterprise as the new route to Canada *via* Blacksod Bay. The idea apparently is to establish a train-ferry between Larne and Stranraer, and thus to run through coaches from London to the Irish port in 14 hours, the distance being 664 miles. Blacksod Bay contains a little village named Termon, and this would be the terminus of the new lines which would have to be built to connect with the main Irish system. These lines would be about a hundred miles long, and it would be necessary for them and the other lines already existing to the west of St. George's Channel to be on the mixed English and Irish gauge in order to get the benefit of through communication. Blacksod Bay is undoubtedly a fine harbour. It is also much nearer Canada than are the ports of Liverpool and Southampton. But when one realizes the expense of making a port there and of building the connecting railway links—to say nothing of the cost of the proposed fleet of 25-knot steamers—one hardly imagines that the scheme will fructify. For Blacksod Bay is a long way from anywhere on this side, and the cost of getting there by express train is bound to be heavy. This will cut down the amount receivable on account of the ocean passage for passengers of the superior class, whilst one would imagine that it would be prohibitive for the emigrants, who it is supposed would travel by it in large numbers from Scandinavia. Third-class passages by such a route would cost the travellers as much, or more than, intermediate accommodation on an ordinary line, and the traffic would never stand it. I therefore venture to prophesy that the suggested scheme will never get beyond the paper stage.

La Compagnie Generale Transatlantique,

which has of recent years added three fine and fast steamships to its New York fleet in *La Savoie*, *La Lorraine* and *La Provence*, is said to be about to complete the quartet by the construction of a fourth and improved sister, to be called *La Picardie*. These vessels are comparable in speed and equipment with the best vessels of the German and British lines, whilst, of course, they are far superior to anything of the Morgan Combine whatever flag we may take.

Speaking of the

Combine

reminds me that I have had an inquiry as to what has become of the Dominion Liner *Ottawa*, formerly the famous mail steamer *Germanic* of the White Star Line. My reply is that the vessel in question is laid up in the Wallasey Dock on the Birkenhead side of the river Mersey. What may be her owners' intentions regarding her I do not know. But she is now about thirty-two years old, and, of course, small indeed by the standard of the present day.

A vessel of the Leyland branch of the Combine has recently been in trouble. This is the *Darien*, a vessel of 3300 tons, built in 1888 by Messrs. Barclay, Curle & Co. for the old West India and Pacific Company. She went ashore at Barranquilla some weeks ago, but at first little notice seems to have been taken of the matter. But by the middle of February it was announced that her rudder and stern post were gone, that she was leaking badly, and that, in the opinion of those in charge of her, she would soon break up if she were not floated.

On the other hand, an announcement is made that an order has been placed with Messrs. Harland & Wolff for a new steamship to be called the *Alberta*. This is to be a twin-screw passenger and cargo boat for the St. Lawrence branch of the Dominion Line. She is to be of about 14,000 tons gross register, and from the published accounts will, I imagine, be of the improved *Republic* type.

The Submarine Bell.

The Queenborough and Flushing Line does not seem to have been put off from the use of the submarine bell by the extraordinary action of the Trinity House. They are installing these bells off Queenborough and Flushing harbours and also on the two Dutch lightships on the route of their steamers. The effect of the Trinity House's refusal to allow the Tongue lightship to be fitted with a bell will, therefore, be minimised as far as lies in the Company's power. But it is not a creditable position for British enterprise, and I fear many people will be apt to remember the humilitating position in which we have been placed by the old-fashioned ideas and ill-timed obstinacy of the Elder Brethren.

LENGTHENING OF CARRON COMPANY'S PASSENGER STEAMERS.

CASES of lengthening steamers by cutting them amidships, drawing the two parts asunder, and filling in the gap rigidly with new material was more frequently resorted to formerly than now, when celerity of construction, cheapness, and thorough up-to-dateness render it more advisable to build new vessels entirely than to tinker at old ones. However, this mode of providing for new requirements of service, or improving upon previous results, is still sometimes adopted in this country, as well as abroad. The success which attended the lengthening of the screw steamer *Forth*, one of the Carron Company's fleet of steamers engaged in passenger and cargo service between London and Grangemouth, about two years ago, has induced that well-known company to carry out a similar alteration to her sister ship the *Thames*. The lengthening and overhaul of the *Forth* was accomplished by the Clyde Shipbuilding and Engineering Company, Port Glasgow, while similar work to the *Thames* has all but been completed by Messrs. D. & W. Henderson, of Partick.

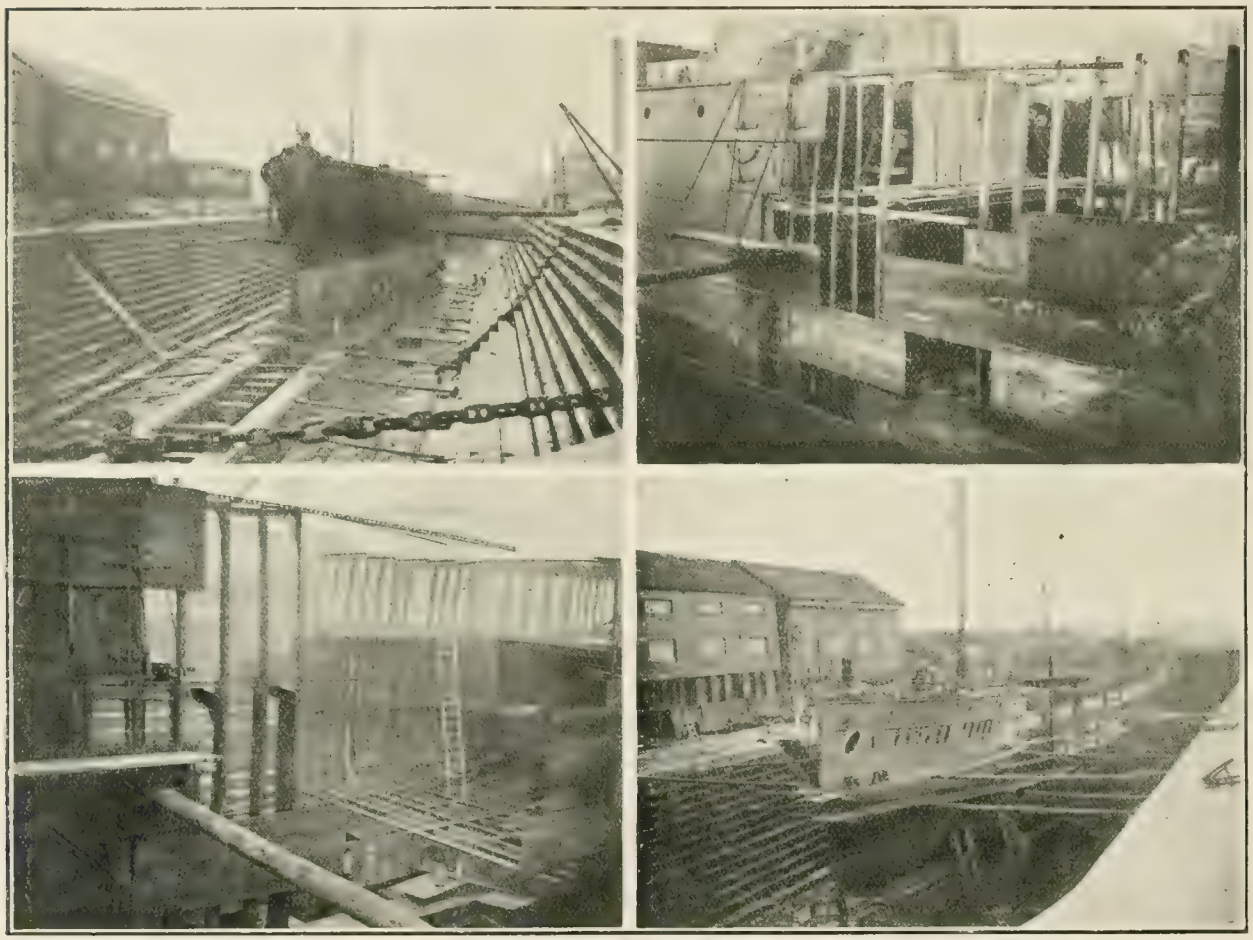
The *Thames*, as originally built, was a vessel of 930 tons gross register, with a length of 230' 0", beam

31′ 0″, and depth moulded 16′ 6″. It was decided to cut her amidships, and increase the length to 279′ 6″, an addition of 49′ 6″; also to provide additional accommodation for 1st and 2nd-class passengers and for the crew. In addition to these important structural alterations the Carron Company decided to re-boiler the vessel with two double-ended boilers and a donkey boiler, all of larger dimensions, and having a working pressure of 180 lbs. per square in., the donkey boiler being arranged to supply steam to the main engines when required. The main engines, to 700 tons. Factors in the speed performances of the lengthened vessel which may be referred to are the increased boiler pressure; from 160 lbs. to 180 lbs. per square inch; also the substitution of a bronze propeller for a propeller of cast-iron.

The designing of the alterations to the *Thames* was placed in the hands of Messrs. Biles, Gray & Co., Naval Architects, London and Glasgow, while, as has been stated, the lengthening and reboilering has been carried out by Messrs. David & William Henderson & Co., Limited, of Meadowside, Partick. The

Showing ways and tackle for drawing apart

Drawing apart



Drawing apart—Finish.

Plating the new length.

Lengthening of the Carron Co.'s Passenger Steamer "Thames."

it was also decided to thoroughly overhaul, and to fit a new propeller of improved design. It is expected that with these alterations (which are now nearing completion in the lengthened vessel, as she lies afloat at the builders' wharf) and under ordinary conditions, the speed will be increased by about half a knot.

While the speed attained in the case of the *Forth*, as lengthened, is at least equal to what it was previously, satisfaction from the change chiefly arises from the increased accommodation and carrying power obtained. The deadweight carrying capacity has been increased by the lengthening from 550 tons

practical supervision of the work has been in the hands of the designing firm referred to, as well as of the Carron Co.'s own representatives, Mr. Filshie, junr., engineer, and Captain Barclay and Captain Ison. The new hull structure which, for the most part, forms the boiler room, is on the ordinary solid floor principle, and this construction is carried into the new No. 3 hold, originally the boiler room. In Nos. 2 and 4 holds and in the engine room the vessel has a cellular double bottom for water ballast. The reconstructed coal bunkers are principally fitted at the fore end of the boiler room. The question of

strength has been carefully considered, and those parts which will be subjected to greater stresses, owing to the increased length, have received special attention. The main sheer strake and the strake below have been doubled for a considerable length amidships, and additional web frames fitted in the bridge space, and in way of the cargo doors.

The previous first-class saloon and state rooms situated under the poop now form second-class accommodation for 56 passengers. The new first-class accommodation for 72 passengers is constructed on the upper and bridge decks amidship. The first-class dining saloon is situated at the fore-end of the bridge deck and extends for the full breadth of the vessel. It is handsomely panelled in polished mahogany and tastefully upolstered and fitted up with electric radiators, etc. The first-class smoking room, and the captain's cabin are on the boat deck, which is above the bridge deck houses, and part of this deck is reserved as a promenade for first-class passengers. The officers' and engineers' rooms are arranged under the bridge deck, the petty officers and crew being berthed forward under the forecastle deck. An installation of generating plant for electric lighting and heating throughout has been fitted. A new single plate rudder of increased area and a larger and more powerful steam steering gear have been fitted. The vessel's equipment of anchors, cables and windlass, has been renewed, and all requirements for Lloyd's highest certificate have been complied with.

The vessel was placed in Messrs. Henderson's hands on the 29th September last year, and the work of opening up the decks and casings and removing the old boilers was immediately commenced. The vessel was partially cut down while afloat in the basin and then docked in Messrs. Henderson's private dry dock, the bow being towards the head of the dock. The cutting of the vessel was continued simultaneously with the construction of sliding ways under the fore part. The four illustrations herewith given—which are reproduced from photographs taken by Mr. A. Fraser, head of the clerical department in the builders' establishment—show the manner in which the vessel's hull was cut, also the arrangements for and the operation of drawing the vessel apart. Regarding the latter a few details may be of interest. A chain cable was stretched across the head of the dock and a strong wire rope was attached to the centre of it and to an anchor buried in the ground. Two wire hawsers were led from the hawse pipes, through iron purchase blocks on the chain, to a winch on each side of the dock, and two powerful hydraulic rams were placed in the bottom of the vessel to give the initial impetus. Sights were placed along the deck to note any change of alignment. These arrangements were completed within 5 days of the docking of the vessel and the fore part was then drawn forward the required distance, the operation taking about nine minutes and being accomplished without a hitch. The vessel was brought up by the checks on the ways to within a fraction of an inch of the required position, the deck sights showing no appreciable amount of deviation. The framing of the new structure was then proceeded with, the frames, floors, beams, etc., having been already prepared from moulds and templates. The plating of the bottom and sides was completed about four weeks ago, the lengthened vessel was then undocked, and the lifting in of the new boilers and the remainder of the rearrangement and overhaul effected. A trial of the vessel for speed and other qualities will shortly take place, after which we will record results.

THE "GEYER" PATENT REVERSIBLE PROPELLER.

IN the illustrations accompanying this article we present to our readers' notice a type of reversible propeller not very well known in this country, but which has come largely into use in America for launches ranging from 3 to 120 horse-power, many of the applications having been made to craft produced by the eminent building firm of Herreshoff. This is the "Geyer" patent reversible propeller as made and fitted in this country by the "Deco" Coy., of Paignton, Devonshire, designers and builders of pleasure and passenger launches. Like most of the reversible propellers hitherto introduced, the "Geyer" propeller is fitted with blades pivoted on a boss, and the angle of these blades can be altered by means of a sliding piece. Most reversible propellers previously made have two blades only, the change in the inclination of the blades being effected by means of gears, but in this case the propeller is made with either two or three blades, each blade being let into a recess cut in the boss, as shown in Figures 1 and 2. The shape of this recess is best seen in Fig. 3. The boss can slide longitudinally on the propeller shaft. In each recess is cut a slot A (Fig. 4), going through to the shaft, and through this slot projects a pin, B, which engages in a slot C (Figs. 3 and 5), cut in the base or flange of blade. Hence if the boss is moved longitudinally on its shaft, the pin B, engaging with slot C, will rotate the flange about the point at which it is pivoted, this being, as will be seen from Fig. 2, a set-pin screwed into the boss, and forming the means of attachment of blade to same. The blade and the flange forming one integral part, the angle of inclination can therefore be reversed by sliding the sleeve as stated.

The method of fixing the blade, it will be gathered from the illustrations, is very simple, but experience has proved that it is also very secure. The centre of pressure of the blade lies between the pivot and the sliding pin, so that the thrust is divided between the two, the greater portion being taken almost wholly by the pin which is an integral part of the propeller shaft; hence only a small fraction of the total thrust is transmitted to the boss, and through it to the reversing lever. An advantage pertaining to this type of reversible propeller is that a solid shaft is used, instead of the hollow one commonly employed with reversible propellers.

Fig. 6, taken from a photo of a model, shows the propeller and the lever handle in the "ahead" position; and Fig. 7 shows the propeller reversed.

of the hubs. The hubs are the smallest and strongest scientifically constructed on the market. All propellers are designed on a true screw. All hubs,

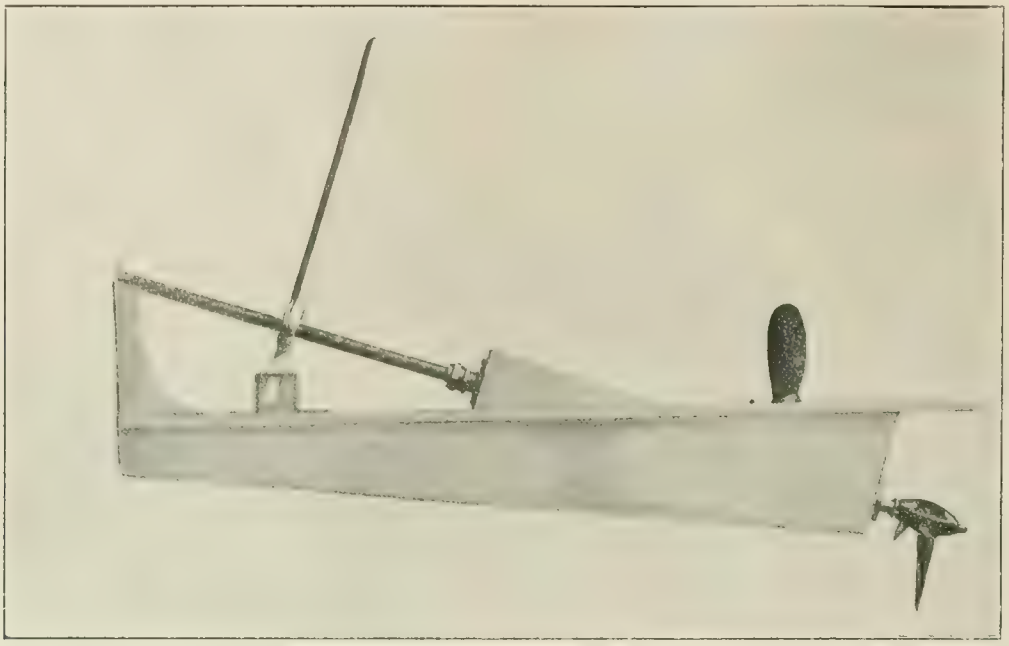
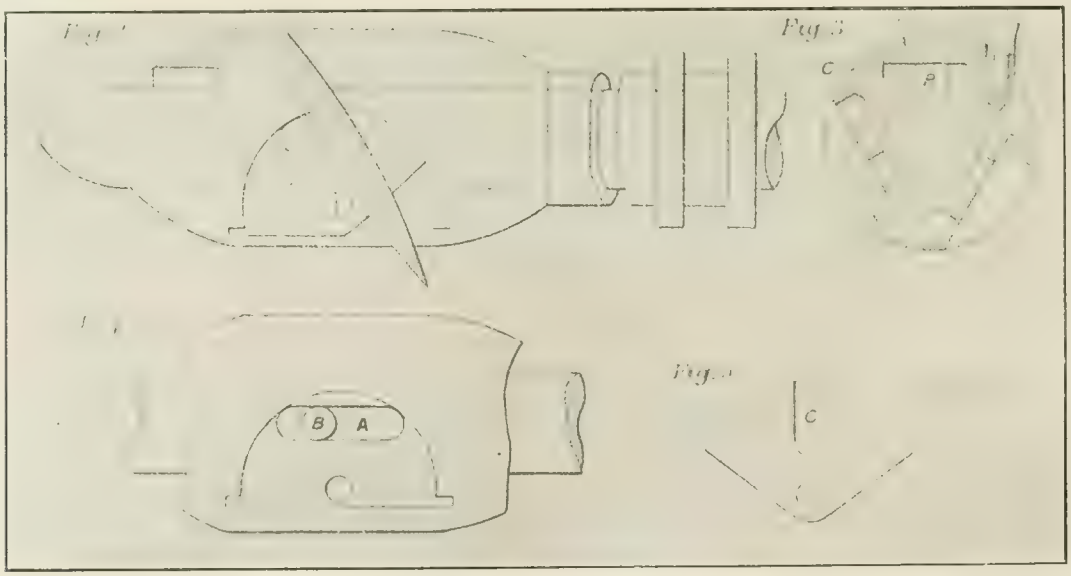


Fig. 1.—Showing One Blade Removed.

The makers claim that the "Geyer" reversible propellers are the strongest, simplest, and most durable propellers yet conceived. The strain or pressure

blades, and stuffing boxes are made of excellent quality bronze, and finished in a superior manner.

For experimental work, on high-speed launches, or



comes entirely on the flat seats in the hub, and on the base of blades and the over-hung semi-circular rabbet

in case of accident to blades, the blades can be easily and quickly removed, by unscrewing one screw only

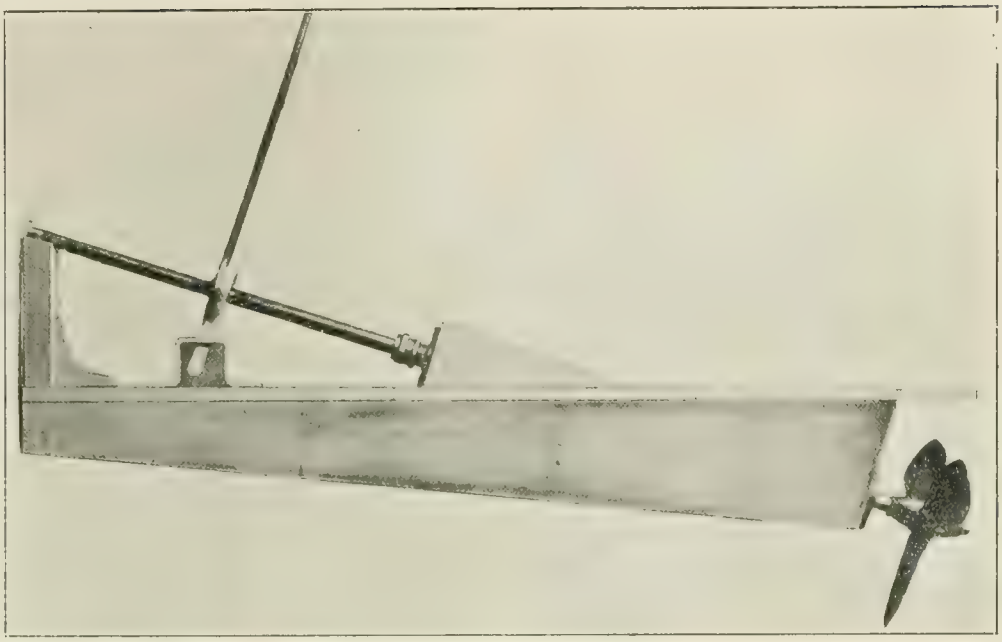


Fig. 6.—Showing Propeller "Ahead."

with a screw-driver, and other blades replaced with the minimum of trouble and expense.

The "Deco" Company also supply non-reversible detachable blade-propellers, equally strong with the undetachable, the mode of attachment having the advantages of ready and effective fitting above referred to. Different sizes and pitches of blades are easily applied without removing hub from shaft.

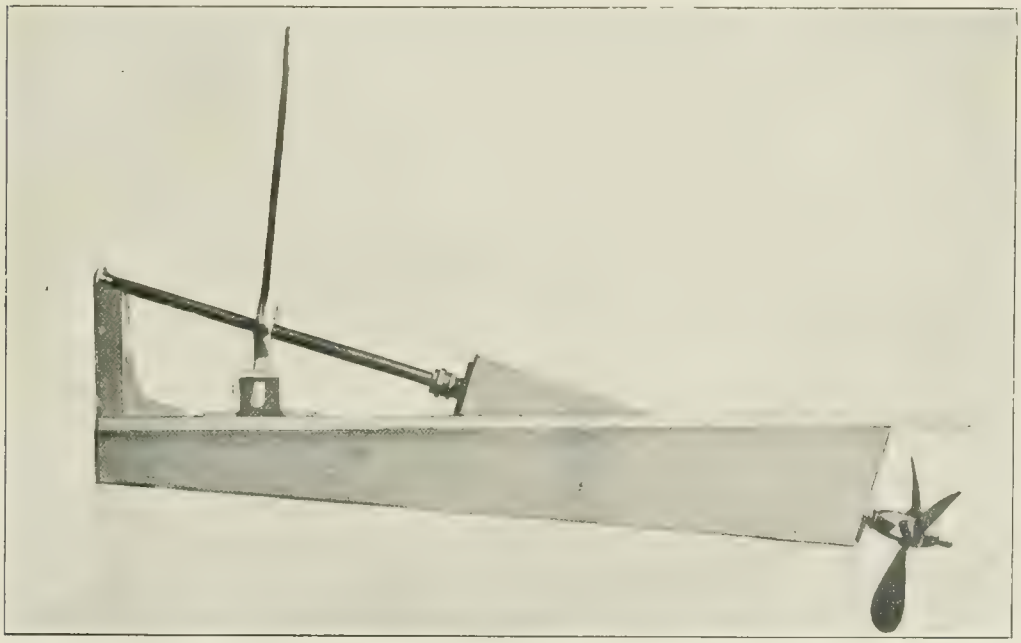


Fig. 7.—Showing Propeller "Reversed."

NAVAL MATTERS—PAST AND PROSPECTIVE.

From our Own Correspondents.

Portsmouth Dockyard.

THE performance of the *Dreadnought* reflects credit on all connected with the building of that battleship. Most extraordinary reports were set afloat as to the vessel, one London halfpenny daily stating that her turbines had "worked in a sluggish manner." All one can say is that if they did so on the voyage from Gibraltar to Trinidad it will be interesting to see what the turbines do when the sluggishness wears off. The vessel maintained a speed of over seventeen knots on the voyage at the conclusion of which the propelling machinery was in excellent condition, indeed, the ship could have proceeded at once with the fuel remaining for another thousand miles at the same speed. The Parsons Marine Steam Turbine Company, the builders of the turbine machinery of the *Dreadnought*, have received a letter from the Secretary of the Admiralty stating that their lordships recognise that the work performed by the firm materially contributed to the early completion of the ship, and adding "I am accordingly to request that you will accept this expression of their lordships' cordial appreciation of the special and successful efforts which have helped to achieve this satisfactory result." The *Dreadnought* will remain at Trinidad until March 21st, during which time she will carry out various exercises, probably in gunnery. She is due to return to Sheerness on March 31st. Very satisfactory progress is being made with the *Bellerophon*. Most of the Bulkheads are in position, as are also the sternpost and stem. Although there is to be no racing between this yard and Devonport for the completion of their ships, I hear that the western port is making strenuous efforts to catch us up, we having had nearly a month's start. We are not making any undue haste; the workmen are kept steadily going, but no overtime is allowed. It is quite likely that the vessel will be launched in July. The sloops *Rinaldo* and *Vestal*, which have been lying at the Motherbank for a long time, have been sent to Sheerness to be fitted as tenders to the Gunnery Schools at Portsmouth and Devonport. Many other vessels at the Motherbank are quite good enough to put into commission. There is the cruiser *Bellona*, for instance, whose sister vessel, the *Barham*, is at present serving in the Mediterranean. The battleship *Prince George*, having completed a somewhat extensive refit, has rejoined the Channel Fleet. It was thought that the vessel might have been strained in consequence of having touched a bank at Spithead while entering the harbour in December, but it was found that she had sustained no damage whatever. The refits of the *Glory*, *Ariadne* and *Talavera* are proceeding. The refit of the *Hawke* is practically completed and she leaves immediately to relieve the *Carnarvon* in the Mediterranean. The repair ship *Assistance* has been taken in hand, but her overhaul will not be very extensive. The destroyer *Eden* has just completed a very extensive refit. She originally had six small propellers on three shafts, but for experimental purposes she has been fitted with three large propellers, from which better results are expected. The vessel is to undergo special trials to ascertain how the new propellers work. It does not yet appear to be quite certain where the new lock is to be. Sir William Matthews (of the firm of Coode & Matthews civil engineers) has been called in by the Admiralty for consultation, and he paid us a visit at the beginning of February and inspected the different sites suggested. Admiral Sir Archibald Douglas, the late Commander in-Chief, had a very hearty send-off when he left on February 8th and the good wishes of Portsmouth follow him in his retirement. Sir Archibald, who had been here nearly two years, was, it is interesting to recall, practically the founder of the Japanese Navy. In the early seventies, when a commander, he went to Japan to advise in the creation of her navy and he organized and commanded the Imperial Naval College at Yeddo. After the late war, in which the Japanese Navy played so important a part, the Emperor decorated the gallant officer with the Order of the Rising Sun as a recognition of his services. Both the Admiral and Lady Douglas were very popular at Portsmouth, for they identified themselves so thoroughly with the charities and local institutions of the borough. The new commander-in chief is Admiral Sir Day Bosanquet; he can only hold the post for a year.

Devonport Dockyard.

The event of the month, the visit of their Royal Highnesses the Prince and Princess of Wales (February 20-22) passed off successfully. As I told you last month, it was for the purpose of opening the North Extension of the Dockyard or Keyham Extension Works, as it is perhaps better known and the arrangements were carried out in accordance with the programme given last month. I hear that Messrs. Cowans, Sheldon & Company, Limited, of Carlisle, have been commissioned to supply the heavy cranes required at the new dock. The order includes one 20-ton and two 30-ton steam travelling cranes, and also two 75-ton electric Fairbairn cranes and one 160-ton electric hammer crane. Rapid progress is being made with the construction of the *Temeraire*. Between two and three thousand tons of material have been worked into the hull, which is now assuming a shapely appearance. If the progress already made is maintained, there is no doubt that the vessel will be ready to take the water by August. The unloading and fixing in position of the stem proved a record undertaking, as it was slung and fixed in four and a half hours after its arrival. This is the shortest time that it has taken to place a stem in position—at any rate at Devonport. Work on the cruiser *Minotaur* is going on apace, and the two lower masts have been hoisted on board. The fire control platforms were fixed before the masts were placed in position, as such work can be dealt with more expeditiously than when the masts are on board. The battleship *Cornwallis* has now rejoined the Channel Fleet. Advantage was taken of her stay here to thoroughly overhaul her machinery and boilers, the torpedo and gunnery equipment and the fire control and wireless telegraphy. Her searchlights were also rearranged, and two additional projectors, electrically controlled, of 36 inches diameter, were added. The refit of the cruiser *Isis* is also completed. While she was in dockyard hands the elements of her boilers, numbering thirty-one, were replaced. This is considered a highly satisfactory piece of work from a professional point of view. It is expected that the cruiser *Cornwall*, which is undergoing a refit, will replace the *Isis* as seagoing ship for naval cadets in the autumn. The *Cornwall* is fitted with Babcock and Wilcox water-tube boilers, and she has a splendid reputation for steaming. Another of the "C" class of submarines has arrived here. These vessels are larger and one knot faster than the "B" class. They have two propellers, an innovation adopted in some of the new French vessels, and also a second periscope. Our submarine flotilla now consists of four "A's," four "B's," and two "C's." The electrification of the yard is making headway, and Messrs. Priest & Cardew, the contractors, have been asked by the Admiralty to complete the work by August. It is interesting to know that Devonport has a future. Mr. Kearley, the senior member for the borough, and Parliamentary Secretary to the Board of Trade, says that Devonport is to be "the premier base of the fleet over all others," and the right hon. gentleman added, "Portsmouth has hitherto occupied that position, but in the near future, when you have the full advantage of all these extensions that have been developing at Keyham, Devonport will hold the premier position."

Chatham Dockyard.

The death of our superintendent, Rear-Admiral Corry, occurred just as I had set my notes last month, and caused a deep feeling of sorrow throughout the district. The late admiral, who succeeded Vice-Admiral Craigie in September, 1905, was one of the most popular officers who have held the command of the yard. He was respected and esteemed alike by both officers and men. The latter had the fullest confidence in him, and recognised him as a friend who was always ready to further their interests when occasion permitted. Indeed, only a few days before his fatal illness he was engaged in formulating a scheme for the establishment of a club among the apprentices. He was as popular with the townspeople as with the dockyardmen. The funeral took place at Chatham and was most impressive,

the Mayors of Chatham, Rochester and Gillingham attending. The new superintendent, Rear-Admiral G. A. Giffard, C.M.G., comes with a high reputation. He was at one time Commodore of the Newfoundland Fisheries Squadron and he is one of the few naval officers who is an Arctic explorer, being lieutenant of the *Alert* under Sir George Nares in 1875-76. The work of building submarines has at last commenced and the experiment will be watched with interest by all who are anxious to see the reputation of the yard fully maintained. The men employed are the pick of the staff. All of them have been sworn to secrecy, and the greatest vigilance is being taken to prevent unauthorised persons obtaining access to the slip, which is entirely enclosed. The officers and men are naturally anxious that the new vessels shall prove a success, as it is felt that it will be a good thing for the yard if more of these small craft are allocated to Chatham. The battleship *Dominion* arrived here on February 12th from Bermuda, and was docked for repairs. Quite alarming and ridiculous reports appeared in some of the London papers regarding the vessel at the beginning of the month, as to her having a "broken back," and likely to founder at any moment. No credence was, however, attached to the reports in naval circles, but at the same time they must have startled the relatives of the officers and men who were on board. The cruiser *Thetis* is to be fitted for service as a mine layer, and the cruiser *Iphigenia*, another mine laying vessel, has arrived here from Portsmouth to assist in the work.

Sheerness Dockyard.

Probably by the time these lines are in print we shall have a new superintendent Captain Startin having unexpectedly been promoted to rear-admiral, owing to the retirement of an admiral. It may be that he will be continued in the appointment, in view of the increasing importance of Sheerness. Admiral Startin has been here just over a year, a couple of months after he came he was appointed an Aide-de-Camp to the King. For the berthing of the vessels of the new Home Fleet additional moorings are to be put down in the Medway near Sheerness, and several existing sets of moorings in the harbour are to be strengthened so as to be available for the berthing of the largest battleships and cruisers. The Admiralty have decided to provide storage accommodation on the Medway near Port Victoria for 20,000 tons of oil fuel, which is to be kept in four 5000 ton steel tanks, surrounded by earthworks. It is proposed to bring the oil steamers alongside dolphins, with connecting works so arranged as to afford a berthage 400 feet long. Gangways will connect the dolphins with the shore, and under them will be fitted oil pumping mains leading to the storage tanks. There will be an oil pumping station and the berthage for war vessels will allow the largest ships to go alongside at any state of the tide. The work of refitting the sloops *Vestal* and *Rinaldo* for service as gunnery tenders is to be carried out here, instead of at Chatham as at first arranged. The vessels were for some time moored at the Motherbank, off Ryde. All their fittings were sent ashore when they were laid up on the scrap heap; their refits will be a somewhat expensive affair. The *Vestal* was built and engined at this yard, and carried out a series of special trials for the information of the Boiler Committee. She will go to Portsmouth when completed to act as tender to the *Excellent*. The *Rinaldo*, which was built by Messrs. Laird Brothers, of Birkenhead, is to be attached to the *Cambridge* for gunnery instructional duties at Devonport. A practical test of the new boom which has been constructed to bar the entrance to the Medway in war time was made on February 14th, when it was placed in position between Martello Tower, Isle of Grain, and Garrison Point. The raft gateway was opened at night and the river was patrolled by six steamboats. Eight torpedo boats were detailed to warn vessels, and pilots were provided for mail packets and large steamers. During the night there was a display against the boom by three divisions of destroyers, the operations being witnessed by Admiral Sir Gerard Noel, the commander-in-chief at the Nore, from his yacht the *Undine*. The scout *Attentive* also conveyed a number of officers from Chatham to inspect the boom, which was found to work admirably.

Pembroke Dockyard.

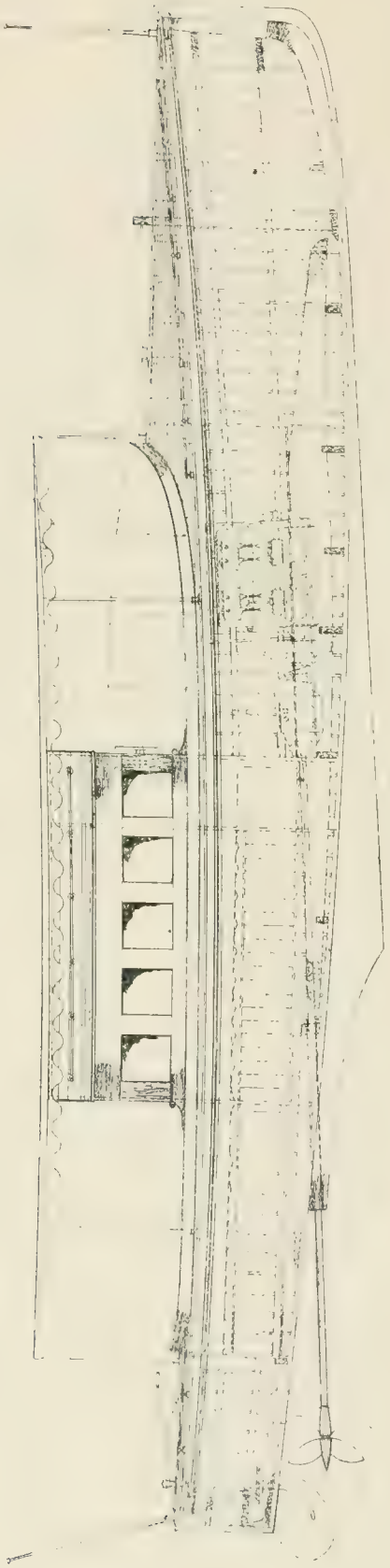
The design of our "mother" ship, or improved scout, which is to be laid down early in the next financial year, will, it is understood, combine the best features of all the existing scouts, while her machinery will embody the latest ideas in marine engineering. She will be the first of the type designed by the Admiralty, all previous vessels having been built by private contractors. It was in connection with the new ship that an inquiry was received from the Admiralty at the beginning of the month as to whether the dry dock could be made serviceable to accommodate a ship 380 feet long. Their Lordships, however must have been aware that the Royal yacht, the *Victoria and Albert*, which is 380 feet long, had been in the dock, and, they must also have known that the vessel sustained some damage by tilting over. This was due to inability to keep the water in the dock owing to the defective state of the caisson. The yard authorities replied that a vessel of that length could not be docked unless the defects were remedied. This could be done by providing a pair of gates to close the dock entrance, instead of the caisson, and this ought not to involve a very considerable outlay. It is stated in some quarters that the new vessel is to be 405 feet 6 inches long, and that their Lordships have sanctioned the enlargement of the dock to accommodate her. The vessel will be completed outright here, without being taken to another yard to be docked preparatory to her steam trials, as has been necessary with the ships built here of late years. The *Warrior* returned on February 7th and was moored at the Carr Jetty. Her full power trials are understood to have been satisfactory, as also were the circle turning and torpedo trials, one torpedo being fired from each tube with excellent precision. The 9·2 inch guns trials also proved satisfactory, the vibration being inappreciable. The four 7·5 inch guns, which will constitute her secondary armament, were not delivered until her departure from here. The vessel will, therefore, have to undergo further gun trials when these have been shipped. The trials will probably take place when the acceptance steam trial is undertaken. According to present arrangements, she is to remain at the Carr Jetty until early in May, when she will be removed to Hobbs' Point Pier. The *Defence* is now almost ready for launching. The postponement until May 10th is desirable to permit of the *Warrior* being practically finished before the launch takes place, thus enabling the *Defence* to be berthed under the sheer legs at Carr Jetty without the *Warrior* being taken to Hobbs' Point while fitting out work is in progress. The postponement is in no way necessary on account of the backwardness of the engineer contractors.

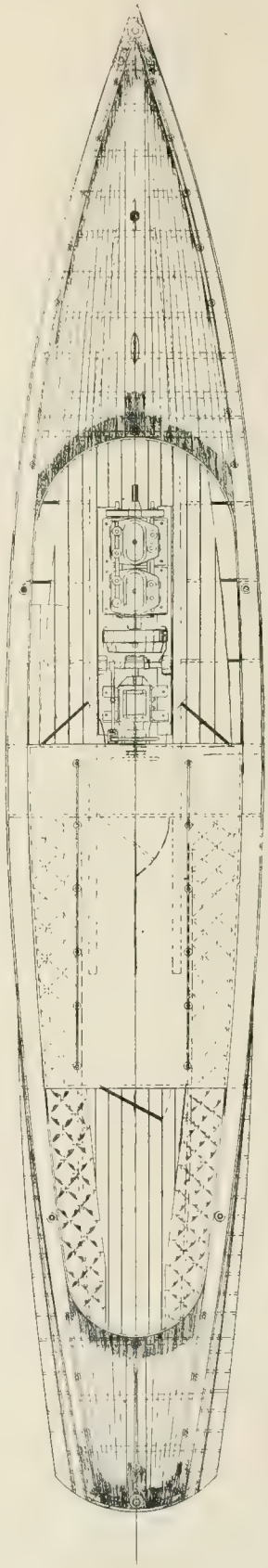
THE MOTOR LAUNCH ARGOLIS.

WE had the pleasure to make a trip upon the Launch *Argolis*, at the invitation of Mr. Jas. A. Smith, M.I.N.A., of 47, Leadenhall Street, London, E.C., who was the designer, and Mr. F. Maynard, of Devonshire Boat House, of Chiswick, the builder of the boat. The *Argolis* is of a well-built pattern, making in the run up river somewhere about thirteen miles per hour, and we found her easy to steer, answering the helm, and making no side wash.

The engine is a 40-50 h.p. Blake Petrol Motor, with Blake patent reverse gear, and occupies the space between the fore deck and the cabin. This engine is a 4 cylinder 4 cycle motor, and is fitted with an Eisman magneto, and double set of ignition.

We found this engine very compact the Blake pedal reverse gear, together with the dashboard and fittings, being immediately in the neighbourhood of the forward steering wheel, has made the launch an excellent single-hander.





Motor Launch "Argolis."

The fuel is stored in a 25 gallon tank in the fore locker and a 50 gallon one aft. The weight of the petrol is thus distributed over the boat, being pumped from aft to forward with a semi-rotary pump.

The hull is constructed with mahogany planking on the double skin principle, the inner skin being diagonal and the outer skin being fore and aft. The planking is stiffened by closely spaced timbers of Canadian rock elm.

We noted the whole structure to be well secured together, all the parts throughout being copper fastened, whilst the stern floors, breastworks, etc., were of selected British oak, there being a number of strong web frames to stiffen the hull against such stresses as might be set up by the powerful motor. At the speed at which we were travelling we did not find any serious vibration.

Motor Launch, "Argolis."

The stern is of the transom type, rounded in the fashion first introduced by Mr. Smith, last year, in Mr. Colls' well-known racing launch *Fleurette*. The top sides aft are well tumbled home, giving an effect of lightness and gracefulness to the after-body, while at the same time the sections are sufficiently broad to provide ample stability.

The after deck is in narrow tapered pine planks, and there is ample storage room beneath it. Between the deck and the house there is a roomy cock-pit, about 6 ft. long, with cushioned seats on either side, and which would hold half a dozen well. In the house, which has square sliding windows, there are two full length sofa seats, 6 ft. 6 ins. long, which might be used as sleeping berths if required; although we were told that the launch was required only for day work. In the forward part of the house are arranged the lavatory, etc., there being a duplicate wheel within the house for steering the launch when the weather is bad.

In front we found a long turtle-back deck of Kauri pine, under which there is ample space for storing the petrol tanks, boatswain's stores, masts, and sails.

The boat is ketch rigged and has been designed, generally, on speed lines, but due attention has been given to her intended service as a comfortable and fast day cruising boat. The free-board we found to be ample enough, and with the forward covered deck should make the boat behave well, even in a heavy sea-way.

ELECTRICITY ON BOARD SHIP.

VI.*

By Sydney F. Walker, R.N., M.I.E.E., Assoc. M.I.C.E., etc.

The Arrangement of Dynamos in the Generating Station *(continued)*.

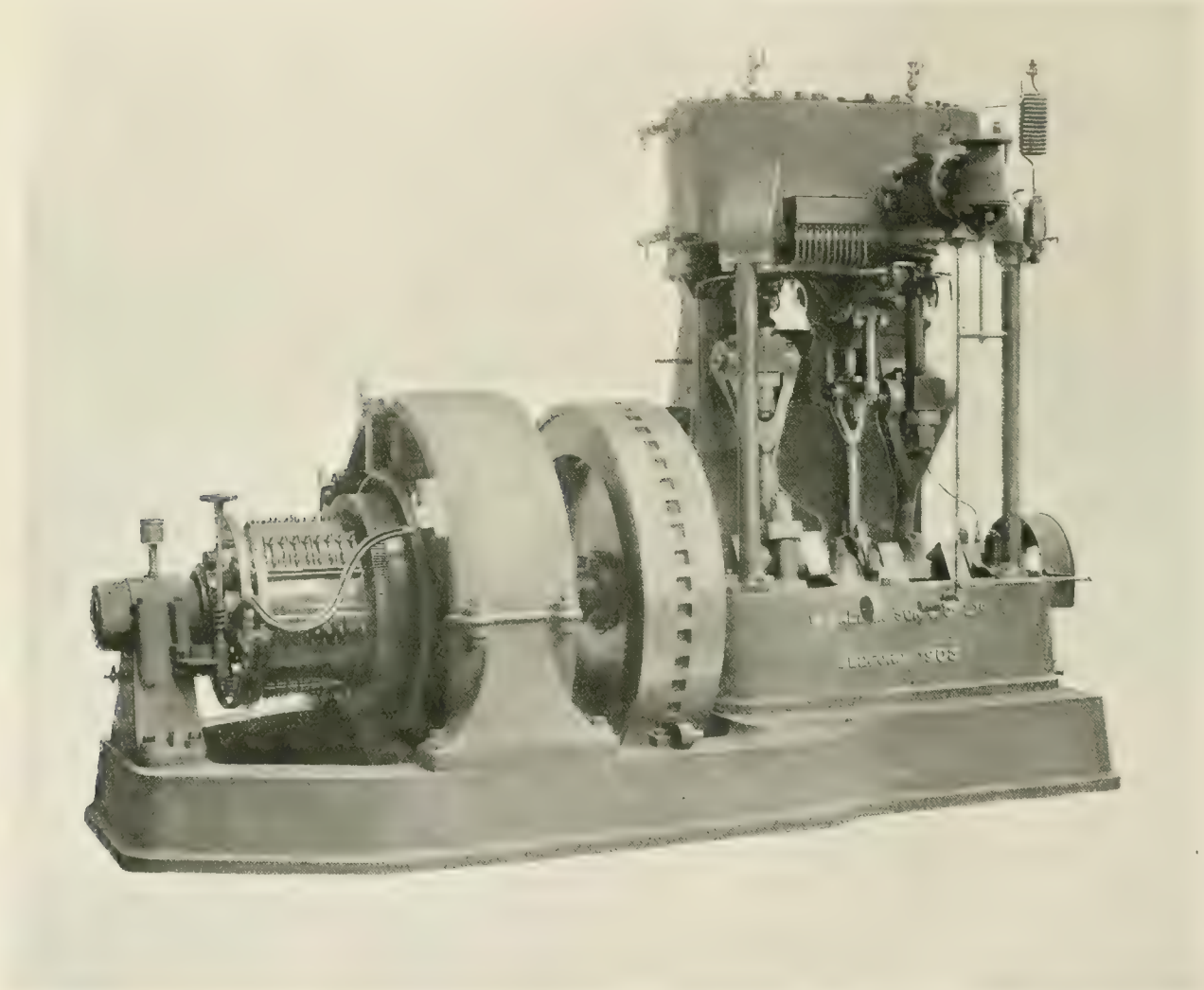
THERE are two methods of arranging the units in the generating station, both designed to provide for an increased supply of current when it is required, when an increased number of lights or an increased quantity of power is being taken from the cables. One of them, the most commonly employed on shore is known as the "Parallel," or "Bus Bar" system The other, which has been employed more frequently on board ship, and which is more suitable for generating stations where skilled attendance cannot conveniently be provided, is known as the "Independent" system. In the Bus Bar system the current from all the generators is brought to two substantial copper bars, the Bus Bars, fixed on the main switch board, and the cables supplying the different parts of the ship, or on shore the different districts, are also brought to the bus bars. As will be explained in dealing with the main switch board, switches are provided for connecting and disconnecting each individual generator from the bus bars, and for connecting and disconnecting each individual pair of cables, "feeders," as they are called on shore, also from the bus bars. The idea in this arrangement is, that all the current generated is delivered to the bus bars, and all the current that is required for the service whether for light or power, is taken from the bus bars. In practice the supply, or feeder cables, are always connected to the bus bars, except when there is what electrical engineers call a "fault" on any pair of cables, the faulty cables being then disconnected. The generators are connected to the bus bars when they are intended to supply current to the service, and they are disconnected at all other times. The Bus Bar system also enables the engineer in charge of the generating station to divide the current that is being supplied to the service, between the generators that are running, in any proportion he pleases. Thus he is able to run small generators and large generators together, on the Bus Bar system, and to arrange that the small generators only take exactly that proportion of the current being furnished, that they are able to generate without unduly heating. He can also arrange to temper the wind to the shorn lamb, so to speak, that is to say, if one of his generators, or one of the engines driving the generators, or any of the accessories are not quite up to the mark, he can arrange that they only do a comparatively small portion of the work, and so can keep them in service until it is convenient to overhaul them. In practice the arrangement usually is, at times of light load one or two generators are running, and are delivering current to the bus bars, the proportion they generate being arranged as described above. When the heavier load comes on, additional generators are run up to speed, the pressure they are to generate at is arranged, and they are switched on to the bus bars and take their portion of the load, as will be explained below. In the case of a generator or its engine failing, a similar process is carried out. There is always a generator running slowly in the generating station with its engine cylinders warm, and all ready to be brought up to

* For Articles I. to V., see last five issues.

speed if required, and to be switched on to the bus bars. When one of the generators in service shows signs of failing, the spare generator is brought up to speed, switched on to the bus bars, given the load that was previously taken by the failing generator, the load at the same time being withdrawn from the latter, and the failing generator is then switched off and can be overhauled.

How the Load is divided between the Units.

The engineer is able to divide the load between the units, in any proportion he pleases, owing to the working of two laws of electricity. One law is, that whenever an electrical pressure exists between any two points, or any two surfaces, a current will pass from the point or surface at higher pressure to that at lower pressure. The second law is, that whenever a current of electricity passes through a conductor, it makes a charge upon the initial difference of pressure that existed between the ends of the conductor, for its passage, the charge being proportional to the strength of the current, and the resistance of the conductor. Put as a formula, this second law reads, $E=CR$; where E is the charge in volts made upon the initial pressure existing between the ends of the conductor whose resistance is R, for the passage through the conductor of the current C, R being measured in ohms, the units of electrical resistance, and C being measured in ampères, the units of electrical current. When a dynamo is running, with its field magnets properly excited, and its armature coils, brushes, commutator, etc., in proper order, a definite electrical pressure is generated in its armature coils. When no current is being taken from the machine, the pressure between the brushes is the same as that generated in the armature coils, and as current is taken from the machine the pressure at the brushes falls exactly in proportion to the charge made on the above formula. Thus in the case of a dynamo arranged to deliver current to the lighting and power service at 100 volts, or thereabouts, the initial pressure generated in its coils may be anywhere from 101 to 105 volts, and the pressure at the brushes will be lowered as the current passing out from the machine increases. The armature coils of every dynamo machine have a certain resistance, that of very large machines is very small indeed, ·01 of an ohm, and less being quite common. With smaller machines the resistance of the armature coils is larger, but it is still small, 0·1 of an ohm being a common figure for small machines. A machine designed to give 100 volts when furnishing 100 amps. may have a resistance of ·05 ohm, and the initial pressure generated in the armature coils would, in such a machine, be 105 volts. When the machine was running with no current passing, except that in its shunt field magnet coils, the pressure at the brushes would be in the neighbourhood of 105 volts. When the current taken from the machine was 20 ampères, the pressure at the brushes would be in the neighbourhood of 104 volts, and so on. It will be seen from this that by



W. H. Allen & Co.'s Compound Engine and Dynamo for Ship use. 102 volts. 750 amps. 230 revs.

arranging that the pressure delivered by any dynamo that is being brought into service, when connected to the bus bars, is a certain figure, while the working pressure at the bus bars is another figure, the dynamo being put into service will be made to furnish a certain current, and to take a certain portion of the load. Thus, supposing the pressure at the bus bars to be 100 volts, and a machine designed to furnish 100 amps. if required, at 100 volts, is to be made to deliver, say, 60 amps. to the lighting and power service. The pressure that must exist at its terminals, when connected to the bus bars, will be that which provides the margin for the charge that will be brought upon it, for the passage of the 60 amps. through the resistance of its armature coils. In this case the machine would be made to deliver a pressure at its terminals of 103 volts. The engineer in charge of a generating station has two methods of varying the pressure being delivered by each individual dynamo. He can vary the speed of the engine driving the dynamo, within certain limits, and he can vary the strength of the magnetic field in which the armature revolves, the variation being accomplished by varying the strength of the current passing in the shunt field magnet coils. In practice, the method usually employed is that the incoming dynamo is run up to speed, and its pressure is set at that of the bus bars, or very slightly above. It is then connected to the bus bars, and if its pressure is exactly the same as that of the bus bars, it will furnish no current. If its pressure is slightly above, it will furnish a small current, and in either case the engineer will gradually increase the pressure generated by its armature, until it is furnishing the current he intends it to deliver. And here comes in one of the objections to the Bus Bar system, where it is not convenient to have constant attendance at the main switch board. Following the first law given above, that a current will always pass from a higher to a lower electrical pressure, if the incoming generator delivers a lower pressure than that existing at the bus bars, when connected to them, say, if its pressure is only 99 volts, while that of the bus bars is 100 volts, it not only will not deliver any current to the service, but its own coils, those of its armature and field magnets, will themselves form paths for the passage of currents from the bus bars, these currents being furnished by the other generators in service. The difference of pressure may be small, say, 1 volt, but the resistance of the armature coils of the generators is also small, and a comparatively large current may be passing through them, with a small difference of pressure. The danger in this case, however, is not to the machine that is receiving current, that is "motoring," as central station men term it, but to the other machines that are connected to the service. When two or more generators are connected to bus bars, and are left to take care of themselves, it often happens that one or other of them either increases its pressure or the reverse. It will be a common experience with engineers that even very well governed engines will sometimes slightly increase their speed, if the engine is well supplied with steam. The proper working of the Bus Bar system demands that the pressures at the terminals of the machines shall be always exactly the same. If the pressure of one machine increases by only half a volt, it immediately commences to furnish more current to the extent of that half volt, and it may happen, and did happen on shore, when the Bus Bar system was first introduced, that one machine of two or three would be taking not only the whole load, but would be furnishing a current to "motor" the other machines, for a certain time, then possibly its engine would drop back, or the charge on its initial pressure would bring its pressure to less than that of the other machines, then sometimes another of the machines took up the running, and so on, the result being that each machine was furnishing more than its proper output, at uncertain intervals, and was strained in consequence. This led to the establishment of the "Independent" system that will be described in the next article.

The Institution of Mechanical Engineers.—An extra meeting will be held on Friday, 1st March, at 8 p.m., when the discussion will be continued by Sir William H. White, K.C.B., Past-President, on "The eighth report to the Alloys Research Committee: On the Properties of Alloys of Aluminium and Copper"; by Professor H. C. H. Carpenter, M.A., Ph.D., and Mr. C. A. Edwards. (Professor Carpenter will reply to the discussion.)

THE "WEAR" MARINE OIL MOTORS.

WE have pleasure in giving particulars of oil motors which are manufactured by Messrs. Lindsay, Carverhill & Company, of Sunderland. We illustrate two of these motors in the adjoining diagrams. Fig. 1 represents an 8 B.H.P. two-cylinder oil motor, and Fig. 2 a 16 B.H.P. motor.

These motors are constructed on the four-stroke principle, and are specially suitable for medium-built

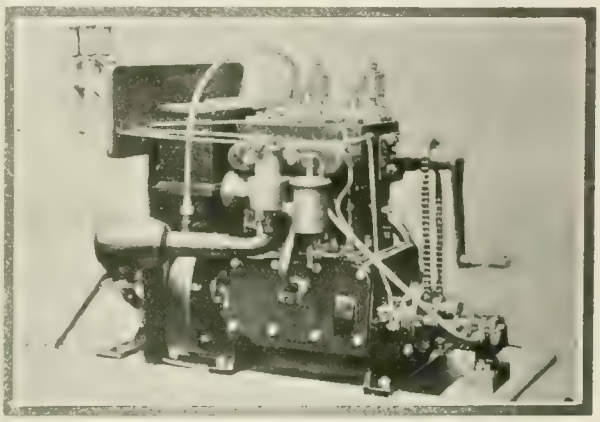


Fig. 1. 8 B.H.P. Two Cylinder Oil Motor, Type A.

boats for sea or river work. They are designed for petrol fuel and run at 600-700 revolutions per minute. Another type is designed for heavy-built boats or small commercial craft, and although designed for petrol, can be adapted for paraffin if required. These engines run at from 400-500 revolutions per minute.

This firm also manufacture a heavy type of two-stroke engines using petroleum fuel and adapted to

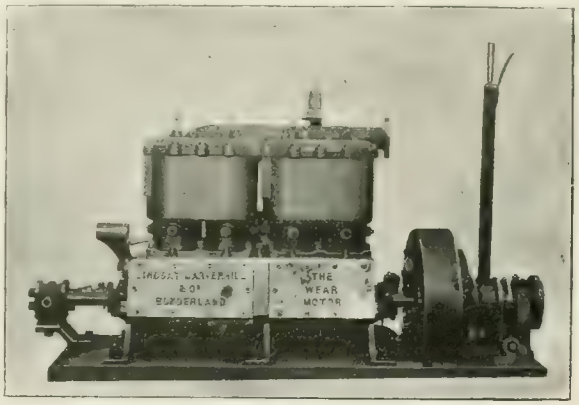


Fig. 2. 16 B.H.P. Motor, Type A, 600 revs.

run from 250-300 revolutions per minute; these are specially designed for barges, fishing vessels and like craft.

As will be seen from the illustrations, the crank cases are enclosed, large inspection doors being provided to allow of ready access.

The feet attaching the case to the vessel are cast on the bottom part so that it is never necessary to disturb the engine from its bed, the case being divided in the centre line of the shaft, so that by lifting the top half the whole of the crank shaft is exposed.

The standard ignition fitted is the low-tension wipe contact accumulator with trembler coil apparatus, but high or low-tension magneto apparatus can be fitted if desired.

Lubrication is carried out by a side-feed system in addition to the ordinary "splash" system. Circulation of the cooling water is maintained by means of a positively-driven pump of large capacity, the amount of water passing through the joint being capable of regulation to get the most economical results from the gases used in the cylinder.

INSTITUTE OF MARINE ENGINEERS.

On February 11th an address by Peter Denny, Esq.* (Vice-president), Dumbarton, was read by the Hon. Secretary to the Junior Section of The Institute of Marine Engineers, and, needless to say, was highly appreciated. Referring to the remnants left of ancient civilization, of the wonderful works of the Chaldean and the Assyrian monarchs, and the records of the inventive genius of King Hiero, Archimedes and others, it was pointed out that evidence was revealed showing that in these far-away days men studied hard, and with the aid of countless armies of unskilled labour attained results which were even now a wonder, and compelled the question whether present-day achievements are so very wonderful, considering that 3000 years had elapsed in which to advance over the magnificent work executed by the old nations of the world. The obvious lesson was that in the days of old, as in the present day, nothing of lasting moment was accomplished without study and labour. A contrast was also presented in the treatment meted out to prisoners of war—in the former days they were compelled by their conquerors to labour incessantly, in the present day they were treated in some respects with more consideration than the rank and file of their victors.

Everyone who had the good of the nation and his profession at heart must feel a deep interest in the life future of those who had set out in the study of a grand profession which might be ennobled or degraded by its votaries, and whose progress and credit might be advanced or impaired precisely as its students approach it in the true spirit of enthusiasm and endeavour, or in the spirit of indifference and a dislike to the arduous labours required of all those who sought success.

To those whose aim was simply to earn a subsistence the work of an engineer offered sure means, and by dint of hard work and a certain expertness such helped to bring the nation to the front and keep it there; but to those who came forward in the hope of doing more than this—who hoped to become leaders of men—who hoped by study and research to leave their mark on the world's history, to do something to enrich and ennoble their profession and benefit their age, there was good opportunity to reach their aim. Many young men lacked the energy and enthusiasm to have any aim, the shock of rising at 5.30 a.m., the tired feeling in the evening, which overcame the intention of attending classes, or study, the scant holidays compared with school days, combined to crush the little energy they may have possessed.

It was urged that every young man who entered upon the study of engineering should do so with a high aim, and with the desire to emulate the example of the great men who had gone before, who had honoured and dignified the line of life they had taken as their own. It was interesting to watch the progress of the young man who was determined to get on. Nothing seemed to daunt him, early rising, long hours, overtime, cold and wet were all in the day's work to him. Foremen and men recognised and admired his pluck, and all their experience was at his service to make his own. The examination for the drawing office came on and he gained his entry there by his industry and study. He has now before him a greater opportunity to advance his technical knowledge. He may gain a bursary or by other means attend the University or College classes, working in the shop during the summer and attending classes in the winter, and by so doing he gains the admiration and respect of his shop-mates. Any honour he gains they look upon with pride and satisfaction, so long as he puts on no foolish airs. If his aim be to adopt the purely scientific side, the search into the abstruse, or the imparting of his knowledge to the younger generation, culminating in the honourable professional chair, he may gain a fame which might be world-wide.

Mr. Denny referred to an interesting personal episode when in his father's house he saw Lord Kelvin, Professor Jas. Thomson, Rankine and Dr. Joule, all of them personalities of world-wide reputation. His personal interest was centred on Dr. Joule, on account of his researches into heat and the data which were the outcome. The care and the painstaking of Joule were dwelt upon to show how anxious he was to put nothing out from himself until he had quite satisfied himself as to its correctness, and in justification of this desire for truth in detail, the heat equivalent given by Joule had practically remained the rule, being verified by other independent searchers. That the attainment of a Professorial chair did not confine one's inventive and commercial faculty was evidenced by the many delicate and important appliances which were associated with Lord Kelvin's name, the compass and sounding machine for example. Then there was the Range finder invented by Professor Barr, which was being manufactured in the West of Scotland works under management which was already an assured success.

The work of the consulting engineer offered a career to those who desired the independence of such, and avoidance of the responsibility and anxiety associated with the management of men. In connection with this, however, a word of warning was given to avoid the danger to the moral stamina associated with a branch of consultative work, that of the expert witness. Who was not familiar with the stigma cast upon a much-loved profession by the words and actions of some who had been renowned specialists in this department, whereby the term expert witness had become a symbol of a mendacity which some wit had graded in a way familiar to most, and had made the name professional witness a blot on an honourable profession and given an occasion for the enemy to blaspheme. The passing of the examination and entrance into the drawing office might prove the stepping stone into experience in dealing with men, and by tact and energy might lead on to works' management, or even beyond that into the inner circle of the firm, from the circle of the employé to that of the employer. There was a pleasure in being in charge of an establishment of industrial life, and there was no less a responsibility and a duty owing to those employed in the establishment in having a deep and abiding interest in their happiness and comfort. Those who ameliorated the condition of, or helped suffering humanity, had a consciousness of taking part in a work which, if generally taken, would make this world a very different place from what it now is.

The great empire to which the rising generation belongs looked to the young men to fight as faithfully in the industrial department as any red and blue jacket, or as the old Greek said of the living wall, in which "every man was a brick," so let it be with every young engineer who looked forward to take a manly place in the world.

At the close of the address votes of thanks were accorded to Mr. Denny, to the reader of the address, and to Mr. W. E. Farenden, who occupied the chair on the occasion.

* Originally delivered to the Engineering Students, Glasgow University.

Mr. J. Arthur Reavell, for many years general manager of the Blake & Knowles Steam Pump Works, Limited, and afterwards a director of the Worthington Pump Co., Limted, has resigned his seat on the board of the latter company, consequent on his appointment from February 1st last as general manager to Messrs. Manlove, Alliott & Co., Limited, of Bloomsgrove Works, Nottingham.

THE REPAIR OF SHIPS' STERN FRAMES BY MEANS OF THE ALUMINO THERMIC PROCESS.

THE repair of stern frames and other parts of large steamers is undoubtedly a question of great importance to all Marine Engineers. The usual practice in this country in cases of fractures involves either a new frame or patching the fracture by means of plates riveted or bolted around the frame, but both processes are expensive, and occupy a considerable time, during which the ship is laid up.

The Patent Alumino Thermic process of welding has been mentioned from time to time as a suitable method for carrying such repairs, offering as it does a rapid and economical method of procedure.

We understand that the process has been adopted in many ports outside the United Kingdom for some

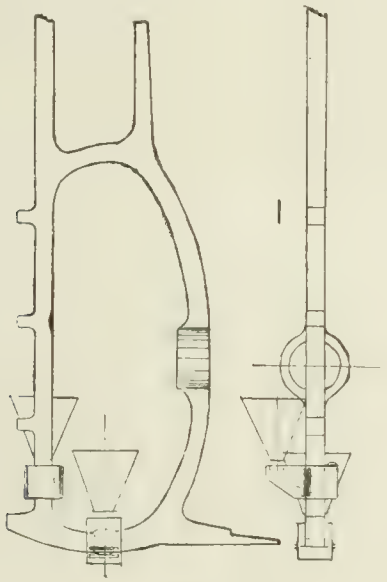


Fig. 1.

years with considerable success, and the German Lloyd's Committee have now formally sanctioned such repairs with certain stipulations as to inspection. The process has, however, not yet been applied to large repairs on steamers in this country which are classed with the English and Scottish Register Companies. This is due no doubt to the fact that those interested in Marine matters have not themselves, up to the present, had an opportunity of witnessing and testing repairs made by the process. This we are pleased to state is now to be remedied, and those interested in this class of work will shortly be able to see the process carried out under practical circumstances. A Demonstration is to be given on the 12th and 15th of March which will interest those who are responsible for large repairs in our shipyards.

The Demonstration is to be held by arrangement with Lloyds' Register, The British Corporation, Glasgow, and the Board of Trade, and will be witnessed by their Principal Surveyors, after which the repaired frame will be placed at their disposal to carry out whatever tests they may desire. We are able to give some particulars of this Demonstration which will be held by kind permission of the Thames Engineering and Shipbuilding Co., Ltd., at their Dry Dock Department, and we understand that anyone interested can obtain tickets for admission on application to the Owners of the British Patents:—Messrs. Thermit, Ltd., 27, Martin's Lane, Cannon Street, E.C.

For the purposes of the demonstration a forged steel stern-frame will be erected in position, as if on a steamer, and will be welded both in the vertical and horizontal posts (fig. 1).

The section of the horizontal post to be welded is $7\frac{3}{4}'' \times 10\frac{3}{8}''$; this will be effected with about 4 cwt. of welding compound. The section of the vertical post

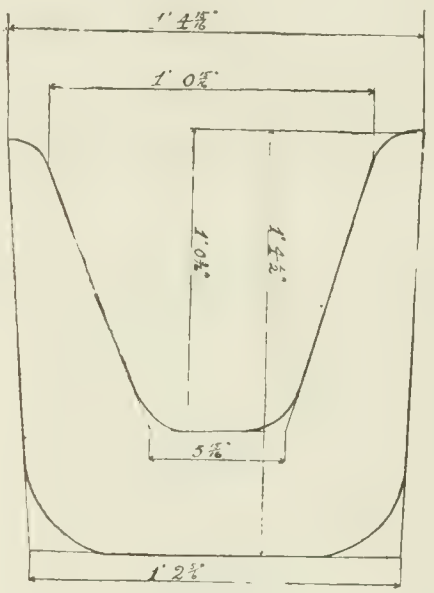


Fig 2

is $11'' \times 6\frac{3}{4}''$, and will require about the same quantity of the compound. Further, in order to show that the process is equally applicable to cast steel, two pieces, each 5 ft. long, will be welded together. The dimensions of these, which are of "U" section and have been specially cast in Sheffield for the purpose to Lloyds' specification, will be seen from the sketch (fig. 2).

About 8 cwt. of welding Compound will be required for this repair.

We are indebted for the above particulars to Messrs. Thermit, Ltd., who are carrying out the Demonstration, and who, we understand, confidently anticipate as a result of their energies that a great deal of interest will be shown as to the use of the process for repair in our shipyards.

ON THE TRAINING OF CADETS FOR THE MERCANTILE MARINE.*

By J. Denholm Young, Member.

A GOOD deal has been written and spoken during the last few years, under the auspices of this Institution, concerning the training and technical education of engineers and naval architects, and these discussions have borne such excellent results that one may be permitted to hope that some tangible benefit might result from a similar round-table discussion upon the training and education of officers for the mercantile marine.

Much ingenuity, scientific knowledge, and practical experience have produced a high state of development and efficiency in the structure and equipment of the more modern steamships in our mercantile navy, and their increasing size and complication, and also increasing value, point to the advisability of a well-grounded and well-trained *personnel* to take charge, not only of the ocean palaces and leviathans which are now manned so well and navigated so faultlessly, but also to do the same for a constantly growing number of large and important cargo steamers.

The amount of national capital afloat in steel hulls is so enormous, that the uninitiated might expect to find greater facilities to be available for the rising generation of prospective officers to obtain a suitable training in their future profession; but with the exception of the cadets of a couple of training ships, the *Conway* on the Mersey and the *Worcester* on the Thames, those who wish to rise in the service have been severely left to their own devices.

There is no doubt that this rough-and-ready system of neglect has produced many excellent officers and master mariners, even as the old methods of engineering apprenticeships produced many good engineers, but just as the march of progress has necessitated a wider and deeper scientific education for engineers and shipbuilders, so it is not unlikely that shipowners may find it advantageous to encourage, and the Board of Trade may find itself led to foster, a broader and more thorough training for ships' officers than many of them have an opportunity for obtaining at present.

The sea profession, no doubt, has, in multitudes of cases, gone down from father to son, and the influences both of heredity and of environment have been at work in supplying deficiencies which would otherwise have been much more acutely felt; but the growing tendency of the age we live in, to choose the less arduous professions in preference to the roughness of seafaring life, renders it all the more advisable that we should train and educate well and thoroughly those who are going to officer and command our ships. If in the process of natural selection, resulting in the survival of the fittest, there are going to be fewer to choose from, it is all the more necessary that a greater proportion of these should be fit; and for the sake of our permanent national prosperity, if not our national existence, it is more necessary in this particular profession than in almost any other.

What, then, are the first requirements of education in this profession? As in building a house we expect to have a foundation that is proportionate in strength, breadth and area, to the superstructure, so in laying the foundation of an educational training for any career, we nowadays endeavour to provide a suitable basis for the later development of the man in his profession, and a brief glance at the demands for special knowledge and direction, that may at any moment be made upon the officer or captain of a steamer, will assist in forming a judgment in the matter.

(*a*) In the department of pure and applied science, the master of an ocean steamer is expected to be sufficiently well versed in the principles of arithmetic, algebra, trigonometry, geodesy and astronomy to be able to apply them to the finding of the position of his vessel in latitude and longitude, by observations of the sun, moon and stars.

He is required, of course, to be an expert in the use of the sextant and other instruments necessary for finding ship's position, compass error, etc., and in the use of the trigonometrical, logarithmical, and astronomical tables that facilitate his calculations.

He has also to use that knowledge, combined with his knowledge of compass errors and deviation, to set and keep his vessel's course for parallel sailing, for traverse sailing, or, if an "extra master," for great circle sailing; to be able to allow for currents and tides, and to understand the laws of storms and cyclones; in short, to be able to do as much actual surveying and laying-off in a single voyage as would suffice for draughting out the levels and curves of the Simplon Tunnel, and this with the disadvantage of using instruments that are never steady, and working from a platform that is never at rest.

(*b*) In the realm of practical technical knowledge the chief officer of a steamer is expected to know every part of her construction and to take care for the preservation of every part of her hull, fittings and apparel; to be an expert with regard to ropes, wires, rigging, sails, anchors and moorings, signals, etc.

He is also responsible for a number of mechanical appliances about the vessel, steam winches, windlass, capstans, and steering gear, all of them fairly complicated machines, and often subjected to much unfair usage from want of a proper mechanical knowledge on the part of his subordinates who may have to do with them. Also, one may mention blocks, tackle and cargo gear, all of which require for their proper care and preservation a fair amount of mechanical knowledge.

(*c*) In addition to the foregoing scientific and technical qualifications, the master of a steamer is expected to be an all-round business man in many departments of commercial knowledge, to be able to keep proper accounts and to be at home with the Customs' laws of various ports; to care for the health of his ship's company and to act as their medical adviser and surgeon when required, except in passenger vessels, where a doctor is carried; to understand the proper interpretation of charter parties, agreements and contracts and the handling of various cargoes; to have at his finger ends the regulations which have been framed for the prevention of collisions at sea; to have a broad knowledge of his legal responsibilities as a shipmaster, in port and at sea, and when engaging and discharging his crews; and to maintain at all times a proper order and discipline amongst his ship's company, while also fostering good-will.

From the foregoing meagre outline it is evident that a good all-round modern education as a preliminary to special training would be very advantageous. One would also conclude that as the master's expert knowledge has to be carried with him through life, and frequently applied in practice, any system in which cramming is in any way involved is highly objectionable.

It is notorious that crammed information is ill-digested and soon forgotten, and no one can estimate the bad effects of cramming upon the useful powers of the brain. Nobody would think of plunging into physical competitions after the same manner as many candidates for Board of Trade examinations plunge into severe mental exertion. For a person to lead a life of physical inaction, say in an office, for several years, and then endeavour to train in a fortnight for a three-mile race would be far from beneficial.

In the same manner, those who have led a life of intellectual inaction for four years or more, are not likely to gain much permanent benefit by suddenly endeavouring to master, within a few weeks, the intricacies of logarithms and nautical astronomy without a properly graduated system of training, and with their intellectual machinery grown rather rusty in parts from want of this kind of use.

The writer does not mean to depreciate those who have passed examinations under this system—they deserve, indeed, all the more credit for acquitting themselves well with so little real assistance and so many drawbacks to overcome—but he would certainly desire to see a more helpful system of training in vogue than is accorded to nine-tenths of our ocean-going officers at present.

A vast amount of honest study and brain-work must have been done at sea by prospective candidates for Board of Trade examinations, but even though the Board of Trade may have endeavoured to frame their regulations and examination questions in such a manner that private study, and study under crammers and tutors, *must* be in the right direction, the day has surely come when the Board of Trade, like

* Read before the N.E. Coast Institution of Engineers and Shipbuilders.

the Admiralty, should throw cramming overboard and establish legitimate training.

The Admiralty have shown how a complete system of training can be evolved both for engineer and deck officers, and any one who has had the pleasure of visiting the Osborne Royal Naval College cannot but be impressed by the methods there employed to give boys of 12 to 14 years of age, not only useful general education, but a thorough grasp and even an experimental knowledge of the practical side of mechanics and engineering, and of experimental methods in physical observation. They obtain a grasp of the connection between heat and work, and of other transformations of energy. They are trained carefully in practical experiment as well as in the use of the elementary mathematical reasoning by which the results of these experiments are stated in general laws; and having grasped these experimentally, they are not likely to forget them.

The writer does not mean to imply that the Admiralty system either could be or should be adopted in its entirety by the mercantile marine. But its methods of teaching without cramming stand as excellent object lessons, and are well worthy of imitation, not only by all marine schools, but by many other schools besides.

Neither does the writer intend to imply that the standard of knowledge required by the Board of Trade should be greatly raised. What he does suggest is some better system of obtaining the knowledge implied by that standard, some method which will not relegate the mastering of the fundamental principles of navigation and the detailed application thereof to a few weeks of coaching up before a Board of Trade examination under circumstances which remind us of Mr. Gilead P. Beck in Besant's novel, *The Golden Butterfly*, when he has bought the whole works of Browning and Tennyson and has only an hour or two in which to master the contents of the crowded volumes before meeting and conversing upon them with the august authors themselves!

There are here and there to be found naturally constituted students amongst seafaring men who can put themselves through courses of private study without difficulty, self-taught or nearly so, with the aid of books and instruments alone.

There are also a fair number of apprentices at sea who are favourably situated as regards tuition by intelligent, educated and willing officers, and who do get a good and workmanlike training under the present *régime*.

But in the face of the numberless difficulties, discouragements, and disabilities to be encountered, one cannot but fear that the two classes above mentioned form a small minority amongst the crowd of their less fortunate comrades.

The statements on this point made by such an experienced and well-informed authority as Captain Blackmore, in his handbook on *The British Mercantile Marine*, form rather doleful reading. Anent the Compulsory Act of 1850, when a higher standard of voluntary examination was abolished and a uniform reduced standard adopted, Captain Blackmore remarks: "The young aspirant, on discovering that no education was required beyond a mere knowledge of figures, troubled himself no more about the matter, until, having put in his four years' time, he went to the nearest crammer to be coached for an examination, all the tricks of which the crammer knew beforehand, and this is a rule which has continued to the present day. Any teaching at sea by masters, with few exceptions, is more honoured in the breach than the observance. Masters no longer think it their duty."

And again Captain Blackmore remarks: "The most mischievous part of the system of examination, without any effort to secure sound education, is that it has tended to burke primary* education and to teach both parents and children that no special education is necessary until the certificate for promotion has to be obtained."

We have so far in this paper been considering the disadvantages of the present state of affairs without arriving at anything approaching to a solution of the problem.

To be continued.

* Secondary?

Civil and Mechanical Engineers' Society.—On Thursday March 7th, at 8 p.m., a paper will be read before this society on "Types of enclosed steam water heaters," by Mr. C. R. Allensby, G.I.Mech.E.

Collapse of a German-built Crane at Barrow.—Messrs. Bechem & Keetman (Duishburger Maschinenbau Act. Ges.), Duisburg, inform us that this crane was *not* built by them, or from their designs, nor were they in any way connected with the construction thereof.

North-East Coast Institution of Engineers and Shipbuilders, Newcastle-on-Tyne.—The fourth general Meeting of the session will be held in the Lecture-theatre of the Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne, on Friday, March 1st, at 7.30 p.m., and the fifth general meeting will be held on Friday, March 15th. Paper on "The Development of the Turbine," by Mr. Robert J. Walker.

Meetings of the Institute of Marine Engineers, 58, Romford Road, Stratford.—March 4th, "High speed Two-stroke Engines with some remarks on external water cooling," by Mr. T. W. Kelly (member). March 11th, lecture, "Engine Construction," by Mr. J. G. Hawthorn (member). March 18th, discussion. March 22nd, Bohemian concert. March 25th, lecture, "Electricity," with experiments, by Mr. A. E. Battle (member). Invitation is extended to all engineers.

Extra Chiefs' Examination.—At the January examination the number of passes were remarkably low, being four in all for the ports of examination. Two of these were from the old-established institution, the City (late Leask's) Academy of Engineering, 4-5, High Street, Aldgate, London. We are informed that in addition to similar successes for the year the principal, Mr. A. E. Battle, also claims successes in Board of Trade and Royal Indian Marine Surveyors Examinations.

Engineering and Machinery Exhibition, 1907.—We note that already the arrangements are in hand for the Engineering Exhibition it is proposed to have in the autumn at Olympia. The list of patrons is not only a long one, but it contains many well-known and distinguished men, while the executive committee is a good strong one. The success of the exhibition thus promises to be quite equal to that held last autumn. In addition to the industrial exhibits it is proposed to have a collection of interesting models and memorials on loan to enhance the value of the exhibition to the visitors.

The Association of Engineers-in-Charge.—The next discussion evening will take place on Saturday, March 2nd, when it is proposed to have a demonstration of lamp-testing and photometry in connection with same. Messrs. Everett, Edgecumbe & Co., the well-known scientific instrument makers, and also the General Electric Company, have kindly arranged to furnish them with all the various apparatus that will admit of the subject being fully dealt with. All grades of membership are cordially invited to be present, but these meetings are not open to visitors.

Calendar.—We have received from the London Sealing Co., of 101, Leadenhall Street, London, E.C., one of their tastefully-arranged calendars, on which is given a reproduction of a photograph showing the S.S.'s *Anglia, Colonia, St. John City, Star of Ireland, Marere, Iurakina, Narrung, Moravian, Banffshire*, and *Highland Corrie*, discharging at the Royal Victoria Dock, London, and of these vessels no less than seven had in them men employed by the above well-known firm of boiler cleaners, coverers, etc., who, it will be remembered, were awarded a gold medal at the Naval and Shipping Exhibition, 1906.

Sir James Fergusson.—Among those who perished amid the havoc of the earthquake in Jamaica the name of the Right Hon. Sir Jas. Fergusson is prominent, and at a special meeting of the Town Council of the burgh of Ayr, the convener of the county, Mr. Oswald, moved a resolution of sympathy with Sir Chas. Fergusson and the other members of the family in the lamentable circumstances which brought about the death of his beloved father. The tribute of respect and affection paid by Mr. Oswald and Mr. Bain—the vice convener—to their departed fellow-countryman showed how highly he was esteemed in the county, of which he was Lord Lieutenant. His numberless acts of kindness and sympathy were referred to in terms which showed that Sir Jas. Fergusson was not only noble and honourable in name, but in spirit and practice, one, indeed, of nature's noblemen.

Ediswan Lamps.—A series of tests has lately been carried out by the Westminster Electrical Testing Laboratory with 16 c.p. 200 volt lamps of nearly a dozen different makes, when the "Royal Ediswan" Lamps showed the best efficiency; starting at less than 3·3 watts per candle, they finished at slightly less than 4·0 watts per candle at the end of 500 hours, the average consumption being but little more than than 3½ watts per candle for the whole period. The candle-power of any of the lamps at the end of the test was within ¼ c.p. of the mean, that is, within 8 per cent. of the rated candle-power. This is the best result as regards candle-power and economy in energy consumption. The average candle-power throughout was well sustained, and the whole of the lamps easily complied with the New Standard Specification except in initial candle-power, which was rather high. The total watts at start and finish was less than 60.

The King's New Turbine Yacht.—The King's new turbine yacht, building at the yard of A. & J. Inglis, Pointhouse, is now well advanced in the plating stage, and but for the fact that the tide is unsuitable, efforts would have been made to have the launching stage synchronise with the visit to Glasgow of the Prince and Princess of Wales, on April 23rd and 24th, to open the re-constructed Royal Infirmary, the extensions to the University buildings, etc. Although the Royal pair will have a strenuous time in fulfilling all the engagements that they have undertaken, as well as others that are being planned for them, the conferring of royal *éclat* to an event so important as the approaching launch and christening of His Majesty King Edward's turbine yacht, may be possible of arrangement. But for the strike of the ironworkers in the autumn of last year, the *Alexandra* would have been ready for the send-off before now. The extension of time which the builders were under the necessity of asking for through the strike, and the extreme care of both builders and Admiralty surveyors in the conduct of work, have prolonged the period of construction. In the equipment of the Royal vessel, no less than in the constructional features, everything will, of course, be of the highest class and of the most modern description. The turbine machinery is, as is well known, being made by the Parson Marine Steam Turbine Company, of Wallsend-on-Tyne. The vessel will be steered by engines supplied by Messrs. John Hastie & Company, Greenock; while, for the electric lighting, heating, ventilating and power installation, Messrs. Claud Hamilton, Limited, Glasgow, will be responsible. This firm, it may be added, installed the electric plant for all purposes on board the Khedive of Egypt's yacht, *Mahroussa*, recently converted from a paddle to a turbine screw-propelled vessel by Messrs. Inglis.

MORTON & GOUDIE'S SPEED AND POWER COMPUTER.

ONE of the latest aids and time-savers to the busy ship-builder and marine engineer in the estimation of the I.H.P. required to drive any proposed vessel at its required speed is Morton & Goudie's Speed and Power Computer, of which we herewith give an illustration. Essentially the instrument is of the slide-rule order, but the scales involved are circular in form and worked on a common centre, thus rendering the instrument most compact. The case containing it measures 15½ ins. square, consisting of two cloth-covered boards which fold together like the boards of a book. In the centre of the right-hand board (which is shown in the illustration) a brass spindle is fixed, and on to this are threaded a "base" sheet, with three circular scales and two discs, the lower one a complete circle and the upper one in three different sections of varying radii, which can be turned about the axis by means of the small knobs shown. These discs are provided with sets of scales round their circumferences, which are therefore removable relatively to one another and to the set on the base sheet, which is fixed on the board. On the left-hand board are mounted some notes on the instrument, the rules of operation, and four worked-out examples for ships of different classes with a comparison of the calculated and actual speed and power data in each case.

From an inspection of the titles of the various scales as shown on the illustration, it will be evident that the designers of this computer have departed from what must be considered the "beaten track." Instruments of this class hitherto offered to the profession deal, as a rule, with the simple solution of the well-known Admiralty formula, the value of the displacement co-efficient being obtained from an empirical scale. Such an instrument fails to take account of the form of the ship, a factor which has an important bearing on its economical speed, and the power result obtained from it cannot be relied upon, unless the co-efficient of fineness of the ship approximates closely to that of the type ship, on which the scales of the instrument are based. Usually an attempt is made to cover this defect in a general way, by specifying I.H.P. correction—factors for different classes of ships; but this is a somewhat crude method of dealing with the difficulty, and by no means a satisfactory one. That the authors of this improved type of instrument have been fully alive to this defect, and have endeavoured to deal with the problem in a more scientific manner, will be evident from the arrangement of the scales shown, and the method of calculation outlined below.

The first step in the power estimation is the determination of the approximate economical speed of the proposed ship, in terms of the length and co-efficient of fineness. This speed is then made the basis of calculation for the power to drive the ship at any other speed. In the notes on the instrument this economical speed (variously termed "limiting speed," or "limit of economical speed") is defined in general terms, as the "particular speed, above which the increase of power for equal increment of speed becomes disproportionate to the increase for corresponding increments below this value." For the purpose of estimating the "limiting speed" there are provided on the base sheet fixed scales of length and limiting speed, and on the lower movable disc an arrow line, A, and a scale of co-efficients of fineness; and the first rule of operation relating to these is stated thus:

RULE I. Given:—Length and Co-efficient of Fineness.
To find:—Limiting Speed.

Place arrow A against Length (a) and read the Limiting Speed on the fixed scale opposite the Co-efficient of Fineness on the lower disc.

The limiting speed being ascertained, the ratio between it and the required speed is next determined; and to accomplish this, scales of required speed and speed ratio are provided on the lower movable disc, arrow lines B and D on the upper movable disc; and C on the base sheet. The second rule of operation relating to these is stated thus:—

RULE II. Given:—Limiting Speed (determined by Rule I.) and Required Speed.
To find:—Speed Ratio.

(a) Place the Required Speed on the lower disc, against the Limiting Speed on the fixed scale.

(b) Keep the lower disc fixed, move the upper disc till arrow B coincides with arrow C, and read the Speed Ratio opposite arrow D.

These preliminaries being arranged, the I.H.P. to drive the ship at the required speed can be determined, and for this purpose a displacement scale and arrow line, E, are provided on the lower movable disc, and a second pair of length and speed ratio scales are provided on the upper disc. The third rule of operation relating to these is stated thus:—

RULE III. Given:—Limiting Speed and Speed Ratio (determined by Rules I. and II.) Length and Displacement.

To find:—Indicated Horse Power to drive the vessel at the Required Speed.

(a) Place arrow E on the lower disc against the Limiting Speed on the fixed scale.

(b) Keep the lower disc fixed, move the upper disc till the Length (b) is against the displacement, and opposite the Speed Ratio read the I.H.P. to drive the vessel at the Required Speed.

From the above it will be evident that, as far as the application of the empirical constants to the calculation is concerned, the instrument is automatic, and the selection of data by the operator is confined to the fundamental essentials of the design, *viz.*, length, co-efficient of fineness, and displacement.

It is stated that the empirical constants involved in this "series of interlinked scales have been deduced by a process of careful comparison, from many progressive trial and

subsequent sea results of efficient vessels of representative types." It is further explained that "the values selected for the constants are such that the result given by the instrument for a twin-screw vessel may be taken as the approximate indicated horse-power to drive the vessel at the required speed on trial; while, in the case of a paddle or single-screw vessel, the indicated horse power on trial may be reckoned from 5 to 10 per cent., less than this calculated value."

The following figures are the results from two examples which have been worked out on the instrument. The actual results obtained on the trials of the ships are also given, so that a comparison can be made between them and the calculated values.

SINGLE SCREW STEAMER.

Length = 500 ft. Co-efficient of Fineness = [illegible] Displacement = [illegible]

It is required to find the I.H.P. to drive the vessel at 10.5 and 10.5 knots.

By Rule I., Limiting Speed = [illegible] knots.

By Rule II. for 10.5 knots Speed Ratio = [illegible] and for 10.5 knots Speed Ratio = [illegible] approximately.

By Rule III., at 10.5 knots, with Speed Ratio, I.H.P. = [illegible] approximately, and at 10.5 knots with Speed Ratio = 10, I.H.P. = [illegible] approximately.

Lowest possible speed on trial = 10.5 knots at I.H.P. = [illegible]. At 10.5 knots I.H.P. = [illegible], so that the trial powers are about [illegible] per cent. less than the calculated values.

TWIN-SCREW STEAMER.

Length = 150 ft. Co-efficient of Fineness = .625. Displacement = 61 [illegible]

It is required to find the I.H.P. to drive the vessel at 11.2 and 10.4 knots.

By Rule I., Limiting Speed = 12.5 knots.

By Rule II. for 11.2 knots Speed Ratio = [illegible] and for 10.4 knots Speed Ratio = 80.

By Rule III., at 11.2 knots with Speed Ratio = 1.00, I.H.P. = [illegible] approximately, and at 10.4 knots, with Speed Ratio = 80, I.H.P. = [illegible] approximately.

The actual powers on trial were 630 and 500, or about 5 per cent. less than the calculated results.

We have had an opportunity of examining and testing the instrument, and can state that in design, arrangement, and get-up, it is a thoroughly workmanlike production. Apart from the intrinsic merit it possesses in virtue of the valuable data incorporated in the scales, its claim as a time-saving device alone makes it a desirable addition to the office equipment of every shipbuilding and marine engineering establishment, where preliminary power and speed estimations have to be made at high-pressure. One minute easily suffices in capable hands for the performance of the set of calculations. The instrument was put on the market about two months ago, and the inventors inform us that it has already been supplied to the leading shipbuilding and marine engineering firms in this country and abroad. It is supplied by Mr. Wm. J. Goudie, engineer, 144, St. Vincent Street, Glasgow.

ELECTRICAL NOTES.

(From our Own Correspondent.)

SUBMARINE signalling has received considerable attention lately, and it may be advisable to recall some of the features of the system, which consists essentially of a bell as a transmitter and a tank containing a solution, and a microphone as a receiver. By having a receiver on both bows of a ship the direction of warning sounds can be determined and course steered accordingly. In early endeavours in this direction a small receiver was suspended over the side of the vessel, it being well understood for many years before that water could be used as a medium to convey sounds, but it was not until Prof. Blake, of the U.S.A., discovered that the hull itself could be applied as a collector for the submarine waves was any real progress made. This was not all, however, for the noise of the engines was communicated to the hull and it was necessary to "damp"

out all local vibration before the framework of the ship could be successfully employed for detecting the other vibrations taken up from the water around. After large sums had been expended in experimenting, however, it was discovered that by placing the microphone in a tank filled with a solution of considerable density inside the ship and fastened to the plates below water level; this tank was the key of the matter, but even then communication had to be made from the sound waves around the ship to the electrical part of the apparatus. The problem to be solved was, therefore one of the greatest difficulty, but we know it has been overcome. The damping out of the vibration due to shipboard noises was secured by the choice of a solution in the tank of greater density than sea water, and also of the use of a transmitting apparatus of high pitch, both having a bowl several inches thick and a high musical note being found most satisfactory for the purpose required. Into the merits of such an apparatus we need not enter, they are sufficiently obvious, but it is curious to note that without any apparatus at all it is said to be possible to distinguish sounds 4 miles away by putting the ear to the inner skin of a vessel 5 ft. below the water line.

At what seems a comparatively recent date it was customary to find hydraulic cranes on dock sides in general vogue, but in recent years electricity has made its way remarkably fast, and we find at Middlesborough that recent extensions comprise both methods. The cranes are of the high gantry type, constructed to admit engines and waggons to pass underneath. The top of the gantry carries a cast steel roller path on which the crane, cabin and jib revolve. The travelling of the gantry can be effected either by hand or electrically. The lifting and sluing gear, with their controlling switches, are installed in the cabin, which revolves round a hollow centre pillar which serves for the entry of the main cables. The lifting gear consists of a 50 h.p. motor, and that for sluing is an 8 h.p. The band brake is normally held on to the brake wheel by a weight, and the passing of current tends to move the armature through a right angle, and this lifts the brake and releases the brake wheel. With the capstans an automatic mechanical brake is employed which, when the capstan head is driven by the motor, releases itself. Should, however, the capstan tend to run back through being overhauled by the weight, the brake at once locks itself and sustains the load. With an electric capstan a brake of this kind is a necessity, as there is nothing to sustain the load on the current being cut off. Tests have been taken of this plant, which go to show a great advantage of the electric over the hydraulic installation. Without going into full details, it appears to be sufficient evidence of the above that for all operations per 100 tons the costs compared as follows: 307·5d. for the hydraulic as against 244·7d. for the electric, or a saving in favour of the latter of 25 per cent.

An interesting plant has recently been completed for the post office by the English De Forest Co., working this system of wireless telegraphy. The installation is across the Wash from Hunstanton in Norfolk to Skegness in Lincolnshire. A small oil engine is used, driving an alternator which gives a current of 9 ampères at 110 volts at a periodicity of 60 per second. The alternator is joined to a transformer through an adjustable resistance coil and a key. The secondary coils of this transformer are connected to Leyden jars for the purpose of absorbing any high voltage pulses and are of a sufficient size to prevent oscillations causing damage to the windings of the alternator. The plates of the Leyden jars are joined to the main spark gap and also to the aërial spark gap, the other terminals of which are connected to the antennæ. An electrolytic receiver is employed, in circuit with which is a battery, a potentiometer and a telephone. The receiver and oscillations give rise to variations in the resistance of the electrolytic receiver, which cause corresponding variations in the battery currents, and so communicate clicks to the telephone. These clicks correspond to the receiver of waves, which are sent forward by the action of the transmitting key. A dot sends out a short train and a dash a long train of waves, and in this way messages are received in the telephone. It will be gathered from this the main points of difference with other systems. The working of this radio-telegraphic installation is given as most successful, a speed of 35 words a minute having been attained on the electrolytic receiver and telephone circuit.

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions of our correspondents.

Training of Officers and Men for the Mercantile Marine.

To the Editor of the Marine Engineer and Naval Architect.

A question of vital importance is the training of officers and seamen for the Mercantile Marine, as, very unfortunately in the writer's opinion, many think that the necessity of teaching these by sailing ship training is a thing of the past, and that as there are no masts fitted with spars and sails to be dealt with in the present-day steamers, such teaching is altogether unnecessary to those who will be called upon, and possibly be allowed to command and man steamers of all sizes and values in the future.

This opinion (with all due deference to those who hold it) is a dangerous fallacy, fraught with liability to disaster in the future, particularly in times of peril and emergency, for it is in such times that the dauntless courage, the instant readiness and ability to realize and deal with danger, that the inventiveness and resourcefulness of the sailing ship trained sailor, comes in so conspicuously and opportunely, to save a disabled steamer and, of greater importance—the lives of those on board.

These vital qualities can only be attained by years of training in a sailing ship, which (unconsciously, perhaps, to the young men themselves) seems to engraft all these characteristics into their very nature, so that if apprentices remain long enough to pass for mates and master they become (after taking a third mate's berth in steam, and graduating upwards) perfectly capable and dependable masters of steamers, with whom extensive property and very numerous lives may be safely entrusted, and the men before the mast (similarly trained) are also endowed with the same characteristics to assist, for no man can deal so successfully with a disabled steamer as those who have had to deal with a damaged sailing ship, and a disabled steamer is a much more difficult task if the engineers are not able to help.

Where youths are taken into steamers straight from a stationary training ship, or worse still, where they are taken into steamers without any previous training at all, how can they ever expect to became masters of their profession? They may possibly be taught something of the art of navigating a steamer under fair conditions when everything is in good order and fine weather abounds, but when difficulties arise in consequence of extremely bad weather, the breaking down of machinery when it requires all the ingenuity of the accomplished sailor to deal with the hull so as to enable the engineer to repair damages, as in the *Umbria*, a few years ago, and many others or even where the engineers are, with all their masterly skill, powerless to help, as in the case of the *Norfolk*, to which you referred in a recent issue, and others that have arisen within the writer's knowledge, how are these imperfectly trained men to know what to do under such circumstances? Would it not be almost a certainty that they would come to grief, either by losing the vessel and many valuable lives or having to engage assistance, if such came within reach, incurring thereby large expenses for salvage services.

The writer thus strongly holds the view that sailing ship training is necessary for both masters, officers and men to navigate steamers, because he has known so many cases where seriously disabled steamers have been brought into port safely by the intrepidity and ingenuity of masters who had been brought up in sailing ships, such feats could never have been accomplished by men otherwise trained.

When a steamer has broken down and is for the time being a mere hull, then it is that the sailor has to contrive some means to prevent her falling off into the trough of the sea and possibly being overwhelmed, and further in continuing this good work by improvising propelling power by getting together from all the resources of the vessel, material for Jury-rig sailing so as to continue on their course until either a harbour of safety is reached or, if absolutely necessary, a friendly tow safe into port.

No doubt it will be said all this may be very good, but as

sailing ships are getting fewer in number how can we train officers and men? This argument appears reasonable, but if the opportunity for commercial sailing ship training ceases, then, if we wish, as the writer most fervently does, that we should maintain a race of qualified seamen for the Mercantile Marine, and as a reserve for our Royal Navy, then sea going sailing training ships will have to be brought into requisition in order that both officers and men may be properly trained as real sailors, thoroughly capable of dealing with a steamer under every circumstance, in all weathers and in cases of emergency, small or great.

The writer is rejoiced to see that his ideas in the direction of introducing sailing ships for the training of apprentices and men have also occupied the minds of practical shipowners and that a movement is on foot for introducing a fleet of sea-going, full-rigged ships of about 2000 tons each for the purpose of thoroughly training at least 1000 apprentices and further to train sailors. If this idea is acted upon no doubt the number of sea going training ships will increase as everything will be done in the shape of teaching the boys all their duties in a scientific manner, and their sea education will be in the hands of expert officers and seamen. A system of this kind will attract many youngsters to go to sea who would otherwise not wish to go in a present day sea going sailing ship where the life is unnecessarily hard, and worse still, where boys have no competent teaching of their profession as they had in the days of Green and Wigram, T. and W. Smith, and many others whose sailing ships were the pride of the country, likewise their officers and crews.

Lord Brassey has done most excellent service in the direction of training cadets for the sea by arranging for them to be taken in Messrs. Devitt & Moore's ships, and Messrs. Devitt and Moore have also done splendid service to the cause by requiring their men to belong to the Royal Naval Reserve, and lately a special effort has been made by which Messrs. Devitt & Moore have taken about 100 boys from the Warspite for sea training in the *Port Jackson* 2380 tons 4 masted barque.

British seamen have been in the past the builders and the defenders of the Empire, and it is to British seamen that we owe our deepest debt of gratitude for had it not been for them we should most certainly have never attained to the position in the world that we enjoy at the present time, and it is necessary to our very existence as a nation that we do everything in our power to maintain and develop as much as possible *the magnificent race of British seamen upon which most undoubtedly the safety of the nation depends.*

THOMAS T. MCELAND.

The Marine Steam Turbine. Second edition. By J. W. Sothern. London: Whittaker & Co. 1906.

THE author in his present preface gives it as his opinion that in 15 years' time all steamers will be driven by turbines, being so confident as he is of their success. This assertion will serve to heighten interest in the matter, but as we reviewed the work on the issue of the first edition it will be sufficient to mention a few leading features. With some preliminaries, first we are shown the action of the steam on a Parsons turbine with particulars of blades and figures as regards velocity. The diameter of the rotor is also fully gone into, in fact, all the calculations required for a general design that are in the author's power. In Section 2 are found the practical construction and actual views of blades. The method of building up is shown completely and the drawings are of the very best for understanding the matter. In Section III., we have data from practice and these go into the most minute details as regards blade measurements, turbine trials under varying conditions, sizes of propellers when driven by this type of engine, which last are given pretty closely with some fine views of same, while at the end are set questions for junior students with answers. From the above it will be seen the author gives us a survey that is worthy of study by all those wishing to obtain knowledge of this branch. He has had, evidently, exceptional opportunities of mastering the subject and it will well repay all those wishing to have a practical acquaintance with Parsons' system, which is known to take the lead in turbine construction in the marine world to-day.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

WHILE January scored a record in the matter of output of new shipping with 28 vessels of 36,000 tons the Clyde's contribution being 24 vessels of 35,000 tons—the month of February, so far as it has gone, does not promise to earn the same distinction. The same remarks apply to the matter of orders for new tonnage. Altogether 17 vessels of about 48,000 tons were reported as having been booked in January but this, it would appear will not be approached by similar figures for February. This may be gathered from the notes which follow regarding fresh contracts, some of which, however, were fixed at the latter end of January after the penning of notes in February 1st issue.

Messrs. Napier & Miller, Limited, of Old Kilpatrick, about the latter end of January received an order from Messrs. Hugh Hogarth & Sons, Glasgow, for a steamer of 2500 tons carrying capacity with good power and some passenger accommodation.

Messrs. George Brown & Company, Greenock, received about the same time an order for a coasting passenger steamer from Adelaide owners, for which Messrs. Muir & Houston, Limited, engineers, Glasgow, will supply triple expansion engines.

The Ailsa Shipbuilding Company, Limited, Troon, have been commissioned to construct for the General Steam Navigation Company, London, a steamer of about 2000 tons gross about 250 ft. in length 38 ft. in breadth 18 ft. in depth and with engines having cylinders 22 in. 35 in. and 50 in. by 30 in. stroke.

Clyde Shipbuilding firms will be fairly represented at the forthcoming maritime exhibition at Bordeaux, which is primarily intended to celebrate the 100th anniversary of the definite establishment of steam navigation by Fulton in 1807. Between 30 and 40 different firms are contributing from this country, and from the Clyde there are to be important exhibits by the Fairfield Co.; Messrs. John Brown & Co., Clydebank; Wm. Beardmore & Co., Dalmuir and Parkhead; the London and Glasgow Shipbuilding Co., Govan; Messrs. Wm. Denny & Bros., Dumbarton, the Scott Shipbuilding and Engineering Co., Greenock; Messrs. D. J. Dunlop & Co. Port-Glasgow, Messrs. Wm Simons & Co., Renfrew; Messrs. Lobnitz & Co., Renfrew; the Clyde Navigation Trust etc. An interesting item to be sent by Messrs. Wm. Simons & Co. will be the model of an elevating deck train channel ferry steamer, which in view of the present keen canvassing of the Channel Tunnel project, and of the train ferry scheme to be shortly brought before Parliament, will be sure to attract interested attention. In this connection it may be added that a scheme is being matured for a train ferry service between Stranraer and Larne.

The shipbuilding yard at Govan occupied in turn by the Govan Shipbuilding Co., Dobbie & Co., etc., and for quite twenty years past vigorously carried on by Mackie and Thomson, whose chief speciality has been steam trawlers, drifters, etc., is now likely to be abandoned, like other establishments of the kind within the harbour of Glasgow proper, for further and much needed harbour expansion. Mackie and Thomson through agents have definitely approached the harbour trust of Irvine, asking for the necessary encouragement in the way of improvements to their transferring their constantly growing business to the Ayrshire port. The Trust have arranged to obtain from the "common good" fund at the disposal of the Town Council a sum sufficient to enable it to draw the necessary dredging of the river and the piling and lifting up of the site where the Govan firm think of laying down their new yard. The Council have also agreed to dispose of buildings already erected to the incoming firm and to divert a road which at present bisects the site in question and to grant, in fact, practically all the facilities asked for by Mackie & Thomson.

The river opposite the yard is at present very shallow, and the dredging from the harbour to this point to the required depth of about seventeen feet, together with the constructing of about four hundred feet of piling will cost several thousands of pounds. The ground which Mackie & Thomson propose to occupy includes the whole of the old shipyard and a large street to the south of it, which will enable them to launch vessels at an angle into the river, and will allow of the construction and launching of ships up to a length of between three and four hundred feet. The construction of the yard, after revised plans have been approved of by the parties and negotiations completed, will at once be begun, and the new yard be in a position to start work at the end of this year or the beginning of 1908. About 500 men, it is estimated, will be employed by the firm at Irvine.

Dumbarton Harbour Board are recommending to the Town Council and ratepayers a scheme of harbour extension, necessitated by the fact that the size of modern shipping has outgrown Dumbarton Harbour as it now exists. The scheme—prepared by Mr. Robert Henderson, C.E., Edinburgh—consists mostly of dredging operations, whereby the harbour and channel will have a uniform depth of something like 20 ft. at high water and a width of 150 ft. The cost is estimated at £25,050. When the new scheme is completed Dumbarton Harbour authorities will be able to deal with ships 700 ft. in length and of 26 ft. light draught. Wm. Denny & Bros. calculate they will need to spend £10,000 to bring their wet dock into line with the improved harbour.

Messrs. Hawthorne & Co., Limited, Leith, have contracted to build for Mr. Thomas Devlin, jun., Newhaven, two steel steam drifters. Mr. Devlin intends to form a fleet of drifters to follow drift net fishing in the North Sea.

Dundee shipbuilders are well employed. The construction of the thirteen steam drifters which the Dundee Shipbuilding Company have on hand has been commenced, while the Caledon Company are engaged in work that will keep them going until the year is well advanced. A contract which has just been received by the latter firm is for a paddle steamer of about 120 feet in length for cruising purposes. The vessel is for a gentleman residing in the south of England.

Aberdeen Harbour Board have decided to apply to Parliament for powers to borrow £300,000 for the purposes of harbour improvements. The Board require to spend £744,944 on new works within the next sixteen years, but after deducting what they had at the credit of the graving dock, and deducting the estimated surplus revenue for the next sixteen years, and after providing for sinking fund and interest, this sum is reduced to £407,608, and in applying for liberty to borrow up to £300,000, it is expected that the gradual but steady increase of the harbour revenue will continue and provide the difference between these two figures.

Satisfactory progress is being made with the erection of the new halls and offices of the Institution of Engineers and Shipbuilders in Scotland in Elmbank Street, Glasgow, opposite the High School of the city, and it is intended that the foundation stone of the new edifice shall be laid on May 1st, when it is hoped Lord Kelvin will be present and perform the ceremony. He is the oldest member of the Institution, having joined in 1859, two years after its foundation by Prof. Macquorn Rankine, and other engineering and industrial notabilities. This being the jubilee year of the Institution it is hoped that the presence of Lord Kelvin may be assured at this and other jubilee celebrations of the Institution. A conversazione and dance are being arranged to take place in St. Andrew's Halls on the evening of May 1st and this will be preceded by a smoking concert of the Institution members and friends on March 23rd in the Grosvenor Restaurant

THE TYNE.

(From our own Correspondent.)

Shipbuilding. In the early part of the month some three or four vessels were launched on the Tyne and it is pleasant to be able to record that each vessel put into the water has since had its place filled by the keel for another. This, of course, is the best evidence of unexhausted order books in the yards concerned, and gives promise of a continuance of a busy time in each of these establishments, for at least three months longer. Repair work has been very plentiful on the Tyne during February, all the leading firms being busily engaged in this line. Messrs. Swan, Hunter & Wigham Richardson have had in hand the steamers *Greenwich*, *Breconshire* and *Askehall*, upon each of which a good deal of work had to be done, and Messrs. Hawthorn, Leslie & Co. have had several Russian boats at their quay for repairs, and one, requiring special attention, in the graving dock. The extensive resources of Messrs. Stephenson's repairing department have been fully utilized during the month, and Messrs. Palmers' docks have been constantly occupied. The Smiths' Dock Company have at present fully a dozen vessels under repair in their graving docks and on their pontoons, or at mooring places on the river, and Messrs. Brigham & Cowen have had their splendidly equipped new graving dock near the entrance of the river in almost uninterrupted occupation since the opening of the year.

The announcement that a new shipbuilding yard of prospectively great productive capacity is being started in Austria, will not cause much satisfaction among shipbuilding circles in this country. Austria has been one of our best customers in the past, and the news referred to is calculated to destroy any hopes that may have existed with regard to the prolonged continuance of this connection. Some Austrian orders may, of course, come this way in the future; but to attract them prices must be low and prompt delivery must be assured. The leaders of trade unions connected with shipbuilding and engineering will do well to ponder this matter, and do their best to help the masters to bring foreign orders to this country; instead of hampering them as they, too often, have been guilty of doing in the past.

We understand that various systems of machine riveting are being further developed in the leading Tyneside yards, and in a short time much of the hand labour at present being availed of will be dispensed with. The fitting out and equipment of the great steamer *Mauretania* is progressing steadily, a very large force of men being engaged on her. The mammoth floating crane is found to be of great utility in hoisting material and auxiliary machinery on board.

Engineering.—Though all the departments of the Elswick Works (Messrs. Armstrong, Whitworth & Co.) are not uniformly brisk, there is quite as much work in hand as there was a year ago, and the number of men employed is practically the same. The steel making department shows, perhaps, the greatest pressure of work; but things are also very brisk in the iron-founding department, and in the ordnance shops. At the marine engine works there is little change to be noted in the state of business, but it is well known that firms have to cut very low to secure new orders, which is a somewhat ominous indication as regards the future. The members of the A.S.E. have made a demand for an advance of 2s. per week in wages rates, and the employers have in very definite terms declined to grant the same. The wages, it may be stated, are now as high as they have ever been and the time is distinctly unsuitable for making an attempt to put them up to a point they have never reached before. An advance of wages would necessarily involve an advance of quotations, which would have the effect of checking the placing of orders, and perhaps of diverting them to other countries. It is easy to see that this latter result would prove a worse evil to the men than to the masters. We hear that the iron moulders are contemplating putting forward a similar demand to that made by the engineers, and it is needless to say that if this is done it will be dealt with by the employers in a similar way. Makers of auxiliary machinery for steamships are finding it increasingly difficult to book orders at the prices that were current last year, and are indisposed to accept lesser prices which, they allege, would involve certain loss. There is still a fair amount of business in the shops but it is felt that this state of matters cannot long be maintained, and that a period of comparative slackness is likely to come about in the near future. In electrical works the state of business continues satisfactory, the rapidly growing tendency to install electric motors for driving machinery in all kinds of workshops being a principal means of sustaining the activity. The severe competition from abroad has still a most depressing effect upon the local forging industry,

rendering it most difficult for even the best equipped establishments in this district to obtain anything like an adeqaute supply of work. Brass finishing and copper smithing works continue to be kept pretty busy, and the copper pipe manufacturing works at Jarrow are having a very satisfactory share of business.

THE WEAR.

(From our Own Correspondent.)

Shipbuilding. Messrs. J. L. Thompson & Sons are still very busy in the shipbuilding department, and are repairing the locally-owned vessel *Jessie Burns*, in the Commissioners' No. 2 graving dock. The last vessel launched from the yard is being fitted out at the firm's Manor Quay Repairing Works. Messrs. Bartram are said to have booked an order for a large steamer for London owners, and it is rumoured that the Sunderland Shipbuilding Company have also secured some further work. Messrs. John Crown & Sons are laying out an additional building berth in their yard, in which there had already been space for the building of two vessels. It is also understood that the firm are about to put down some additional machinery. Messrs. Austin have launched a second vessel this year, and in the repairing department are exceedingly busy. The s.s. *Dorrisbrook* has been on the pontoon dock since the beginning of the month receiving a general overhaul, including new bulwarks etc. The vessel had received serious damage in a hurricane last year, and having been temporarily patched up near the place where she was driven ashore, was brought home to be rejuvenated at the Wear dockyard.

Messrs. Robert Thompson & Sons have received an order for a good sized boat for London owners, the construction of which will be commenced immediately, and they have three smaller ones building which it is stated are for foreign account. Messrs Short Bros. are just now laying down a vessel of 10,000 tons capacity which is understood to be for Greek owners, and they have another of between 7000 and 8000 tons capacity in course of construction. They have a still smaller vessel in hand for Norwegian owners, and one being fitted out at their repairing wharf for the Nitrate Company, Limited.

Engineering.—Work in the marine engine establishments continues to be fairly active, but many people expect a lessening of briskness before the summer season is far advanced. In the smaller works there is little change to note; but many of the foundries are short of orders. Forges have little work in hand, but the local ironworks are still kept pretty busy. The new Brass Foundry and Copper Works that have been erected by Mr. R. Willison, of Allea, at the top of Strand Street, Monkwearmouth, are about ready for occupation, and will, it is understood, commence working shortly under very favourable auspices.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

At a recent meeting of the Manchester Association of Engineers, Mr. A. V. Coster read a paper on "Marine Gas Propulsion, and its relation to Imperial Commerce and Defence." The author of the paper contended that marine propulsion by gas engines was rapidly coming to the front. Many leading marine engineers were devoting their attention to it. The gas engine turned into actual work about twice as much as the best reciprocating engine or steam turbine, the fuel consumption being much smaller, while bunker room might be reduced one-half, or the vessel's radius of action increased 100 per cent. in favour of marine gas propulsion. He claimed six advantages, *viz.*: the ship driven with half the amount of fuel; stand-by losses reduced over 75 per cent.; working pressure confined to the engine cylinders; no boiler tubes, etc., to burst; no priming in heavy sea-way; and no more difficulty in the firing of boilers in a beam sea. Gas producers might be charged only twice in 24 hours and the rolling and pitching of the vessel was rather an advantage than otherwise. Some of the difficulties in connection with the adoption of gas engines were mentioned, amongst them that of reversing; but by numerous plates and diagrams it was shown how this could be overcome. Gas plants, he said, required no funnels, nor did they emit smoke. Our navy must be kept up-to-date. Marine gas propulsion would be a step in the direction of efficiency in the navy. By having battleships without smoke, another step would be to dispense with funnels by utilising the hollow steel masts, which carry the fighting tops for the purpose of gas and blow off exhaust pipes.

The half-yearly meeting of the Ship Canal Co. was held on the 14th February. The revenue receipts for the last half year of 1906 amounted to £265,660 and the expenditure to £130,304, leaving a credit balance of £135,356. The profits of the Bridgewater department were £15,299. With banker's and general interest added, the total profit on the half-year's working was £151,687. The total weight of toll-paying traffic for the half-year was 2,457,788 tons as against 2,260,227 tons in the corresponding six months in 1905. The result of the half-year's working of the Ship Canal Department was an increase of £24,969 in the receipts, of £4,007 in the expenditure and £20,962 in the profit, as compared with the corresponding half of the previous year. It should be noticed that the increase of £4,007 in the expenditure is in comparison with a half-year during which the sum of £2,377 was expended on the official opening of the new dock. Since the opening of the Ship Canal in 1894, the traffic has increased every year from 925,659 tons to 4,700,924 tons. The receipts for the year just closed showed an increase of £40,401 and the expenditure of £17,439, including a provision of £8,000 for the accident at the Irlam Docks. The net result in the working profit was an increase of £31,962.

It will be well remembered how the Manchester Corporation advanced £5,000,000 to pull the Canal out of its difficulties during construction, and every ratepayer of the city has had to bear his share of the burden in the form of a Ship Canal rate ever since. That burden is now almost removed. The directors have paid during the year nearly £126,000 for interest. The total amount required to meet the full claim is only £160,000, and it will thus be seen that if 1907 is as prosperous as 1906 has been, the full interest will be met and the Ship Canal rate will have come to an end. Pessimistic grumblers who suggest that the Canal is doing nothing for us, and who gloomily hint that nothing is to be expected from it in the future, may with advantage be reminded of points like these.

The chairman, commenting on the report, said the exports of coal showed an increase of 222,000 tons. They had paid out of their earnings to the Manchester Corporation £5,390 more than their forecast represented, and if it had not been for the Warrington litigation and the Irlam accident, they would have paid £23,000 more. The forecast for this year was £155,000 and if they had anything like a fair increase of traffic they would be able to pay the Corporation the full £160,000 required. He proceeded to justify the expenditure on Capital account without which it would not have been possible to deal with the largely increased dock traffic during the past year. Liverpool during the last six years had spent six and a half millions of money in reconstructing her old docks in order to accommodate the larger type of vessels now in vogue, and last year the Dock Board got parliamentary powers to spend another four and a half millions in further extensions. If cotton spinners would only take the matter up they might have a spot cotton market in Manchester, which would be an advantage to the spinning trade as well as to the Ship Canal.

No questions were asked and the report was adopted.

Two "extraordinary meetings" were then held and the shareholders assented to the directors promoting bills to authorise the working of mines and minerals under and adjacent to the Bridgewater Canal and the execution of works by which to increase the water supply of the Canal.

The works connected with the deepening of the Manchester Ship Canal in the estuary section have been completed; also from Latchford to the Partington Coaling basin. The uni-

form depth from Eastham to Partington is 28 feet. The deepening of the other sections of the canal is progressing satisfactorily. The sluice protection works at Latchford Locks are completed; additional jetties at various points of the canal are in progress, and more railway sidings have been brought into use. The insulated chamber for the sorting and delivery of frozen produce in transit shed No. 2, dock No. 9, is in use, and an office for the use of H.M. Customs is being erected at the Manchester Docks.

The return of the Manchester Ship Canal traffic for January this year was £380,000, as compared with £360,150 for January, 1906.

In oil imports, Manchester has now been placed second to London. For some time past the arrivals have exceeded those for Liverpool and Birkenhead combined. This applies both to tankage and barrel oils. Manchester tankage has a capacity of 22,141,568 gallons. Oils are despatched almost daily to all parts of the country and also to Ireland. Last year the imports to Manchester *via* tank steamers were 50,281,000 gallons against 38,854,000 gallons at the Mersey ports.

It is rumoured that two large engineering companies, one in the West Riding and the other in the Midlands, are about to remove their works to Manchester in order to take advantage of the Manchester Ship Canal, which affords the best facilities for their exports and imports trade. Both companies are largely engaged in the manufacture of locomotive engines and other railway material. One firm is negotiating for a site of more than 20 acres.

At the third annual meeting of the Manchester Marine Insurance Association in Manchester, it was pointed out that the insurable value of the exports of textiles and machinery had increased last year over the previous year by £10,500,000. The Levant, Egypt, Central and South America and the Far East were responsible for about six millions of this total. Manchester Insurance Companies are largely interested in these branches of trade.

The Lancashire coal trade during the month has shown signs of great vitality. There has been a largely increased demand for all kinds of coal, especially for steam, shipping, and for household purposes. Prices have risen considerably. All stocks of steam and engine coal have been cleared out, and consequently are very scarce. Shipping coal has shown a large increase. This branch of Lancashire trade has gone up enormously during the last twelve months. Coal for domestic purposes has been almost equally difficult to get. Stocks at the collieries have been everywhere depleted. Great complaints have also been made by colliery proprietors of the difficulties experienced in the matter of transit of both full and empty trucks by the railway companies. Average quotations per ton at the pit's mouth are as follows: best house coal, 14s. 6d. to 15s. 6d.; secondary, 13s. 6d. to 14s. 3d.; common, 10s. to 12s. 6d.; burgy, 8s. 10d. to 9s. 6d.; best slack, 8s. to 9s.; medium, 7s. 6d. to 8s.; common, 6s. 9d. to 7s. 3d.; shipping coal for bunkers and export, 10s. 6d. to 11s. 6d.; furnace coke, 17s. to 24s. At some pits in the Manchester district these prices are exceeded, the best house coal fetching as much as 16s. 8d. per ton. At the Manchester and Salford wharves, still higher rates are charged, and of course, with increased amounts for delivery.

The iron market during the month has shown some weakness with regard to pig iron. The reports from the United States and the continent of Europe have been somewhat conflicting. Buyers here have hesitated to place orders anticipating probable further reductions in makers' prices. In steel and manufactured iron, copper and tin, prices have been steadier and taking one week with another there is little difference to record. Average quotations are as follows: Scotch metal delivered Manchester Docks: Eglinton, 71s. 6d.; Dalmellington, 71s.; Glengarnock, 73s. 6d.; Gartsherrie, 74s.; Middlesborough iron, 65s. 9d.; Derbyshire, 65s.; Staffordshire, 63s.; Lancashire, 70s.; Lincolnshire, 63s.; ditto foundry, 61s.; ditto, forge, 59s.; hematites (West Coast), 75s.; ditto (East Coast), 78s.; billets, £6 5s. to £6 10s.; scrap iron, 65s. to 67s. 6d. Manufactured iron: iron bars, £7 15s.; steel rounds and squares, £8; flats, £7 15s.; angles, £7 10s.; tees, £7 17s. 6d.; joists, £7 10s.; channels, £7 15s.; iron hoops, £8 7s. 6d.; steel hoops, £8 10s.; steel boiler plates, £8 12s. 6d.; steel ship plates, £8 2s. 6d.

THAMES.

(From our Own Correspondent.)

THE Port of London problem has again been very prominent. The shipowners have spoken and at their meeting on the 15th ult. made it clear that they favour the London and India Dock Bill to be brought forward during the current Parliamentary session, the resolution passed being to the effect that such bill with modifications would afford a reasonable settlement of a difficult question, and earnestly asking the Government to use their best influence to obtain the passing of the measure. It is noted that nearly seven years have elapsed since the Royal Commission inquiry into the question was appointed and that such delay has caused serious detriment to trade generally. The chairman of Lloyds' Registry, Sir John Glover, presided, and the meeting was thoroughly representative. The chairman of the Dock Co. explained the provisions of the bill, the main points of which we have previously noted. Import goods are by its provisions to pay due, and if carried, the new Albert Dock extension would be ready in 1911. Though, however, the shipowners supported the proposed bill, the London Chamber of Commerce have pronounced themselves in favour of a Port Authority, but probably it will be thought that the shipowners' views are the more important of the two.

The London and India Dock Co.'s half-yearly meeting was a very satisfactory one. 192,000 tons of extra shipping entered the docks and this naturally showed in the accounts. It was brought out that no less than one million tons of extra shipping had entered the docks in a year, since 1901, which fact points to the necessity of increased accommodation necessary for the intervening period of six years. It may almost be said that the question is crystallizing now and that something will certainly be done.

The fourth of seven coastal destroyers to be built by Messrs. Thornycroft was launched from the Chiswick Yard recently with machinery all standing. The vessel is 168 ft. long by 17 ft. 6 in. beam and the contract speed is 26 knots. The vessel is fitted with Parsons' turbines and Thornycroft boilers.

A well-known name on the river in the person of Mr. G. A. Mackrow, who was naval architect of the Thames Ironworks, has passed away. This gentleman was responsible for many productions in shipbuilding turned out by this well-known firm, with which he has been associated for so many years, chiefly, perhaps, in the production of armour clad vessels.

The Engineering Exhibition at the Olympia last year was so successful that we are to have a repetition in the ensuing autumn and the matter is already in hand; a special feature is intended in a loan and invention department. The exhibition will be open from September 19th to October 19th, both dates inclusive. The Imperial Technical College—London Charlottenburg as it is known—is likely to be inaugurated at an early date, as the Board of Education has decided to take action upon the report published at the beginning of last year. The scheme is to embrace grouping existing colleges, but will have no connection with the University of London. The colleges included are the Royal School of Mines, the Royal College of Science and the Central Technical College, with other institutions. It will have a governing body of forty members, which will be a thoroughly representative one.

The Prince of Wales has made an inspection of the Naval Volunteers at their headquarters in Lambeth. Practical drills and exercises were carried out to show the efficiency of the division and His Royal Highness expressed himself as highly satisfied with all he saw. There were about 700 officers and men on parade and great credit is due to the commanding officers and instructors for the degree of proficiency attained.

The report on the disturbances at Greenwich Observatory, due to the contiguity of the County Council's electric station is now issued. The recommendations include turbine engines and perfectly balanced dynamos for further extensions so as not to cause vibration, and when this is in place the reciprocating engines in the first portion not to be used after 10 p.m. The two chimneys of the second portion to be not higher than 204 feet above ordnance datum. No further extensions to be made above the 20,000 kilowatts now contemplated in the second portion.

The next Thames bridge to be widened is that of Putney; the immediate reason for which is the carrying of trams over it. Whereas on the south side there is now only a width of 40 ft., this will be 54 ft. when completed, and the contract for the work is about to be given out.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow.—Very little new business has been done by local shipbuilders during the month, and the enquiry for new tonnage is very quiet. Several orders which were expected to come to Barrow have either been placed elsewhere or have not yet matured. There are several of the latter and any day may bring them to Barrow as they are of a special class which is likely to lead to their being ultimately placed with the Vickers firm. But in the meantime the work in hand is only small. The shipbuilding department of the Barrow yard has not been so quiet for some time. Apart from the order for a survey steamer for the Indian Government and a large battleship for Brazil, the construction of which has been delayed for some time, and several submarines for the British Government, there is no other work in hand at present. The yard is quite capable of putting down half a dozen warships and a dozen merchantmen at one time, and it stands to reason that as Vickers, Sons and Maxim have spent so much money in its full equipment they will soon find work for it from one source or another. There is no doubt there is some very keen cutting in the shipbuilding trade at present even among the builders who have the highest repute for good work and it is evident that those who desire to secure orders in the future will have to be satisfied with a smaller share of profit than hitherto even if this to some extent has to be made good by economies in the various departments so as to ensure cheap and at the same time highly satisfactory production. The designs for the Brazilian battleship in hand at Barrow have not yet been completed. It is understood that she will be ultimately approved at a tonnage of something over 19,000 tons, or larger than the *Dreadnought* and with that view preparations are being made to lay her down on another berth altogether to that on which the construction of the vessel first ordered was commenced. There is still considerable activity in the submarine department, where the vessels are built in a specially provided shed away from the public gaze. The submarines under construction at the moment include some very much larger than the A, B and C types already built. Indeed, some of the C class are still under construction.

A remarkable accident occurred in the first week in February to the new electric cantilever crane built for Vickers, Sons & Maxim by a firm of German engineers at their new Buccleuch Dock fitting-up wharf. This crane, which was designed to lift 150 tons at 174 feet in height from the dock level, and has a flying jib of 214 ft. in length, with a full all-round radius. She had also a counter balance on the other end of the crane, and this was designed to represent a deadweight of 130 tons. In the dead of night, in the early part of the month, this counter balance gave way and fell on to the wharf beneath an with awful crash. In the course of its fall it damaged the tower which carries the crane itself, and it is questionable at the moment whether the whole fabric will not have to be reconstructed. It is difficult to determine as to the cause of the accident, except by some error in the design. It may, of course, be bad workmanship, or the result of using bad material. At any rate these are only surmises, and it will be a question for the engineers to determine on the actual cause, and, of course, in the work of reconstruction care will be taken to avoid a recurrence of the disaster. The firm have already at work a 150 ton electric cantilever crane at their Devonshire Dock fitting-up wharf, which has answered all expectations admirably. These cranes have a somewhat flimsy look, but they are built strong and light, so as to be able to resist the very strong wind pressures which are frequently experienced in Barrow. They are built up on amazingly strong foundations and in the instance of the crane which has been doing its work at Barrow for some time evidence has been given of its firmness and solidity. It is understood that the damaged crane is not yet out of the hands of the contractors, as it has yet to be proved that it can do the work which was specified in the guarantee and this test cannot be made until the counter balance has been reconstructed or the crane rebuilt altogether. The accident will represent the loss of many thousands of pounds, no matter who has to pay for it.

There is considerable activity in the engineering shops, but this is not on marine engines. The works are filled with gun mountings, the orders for which are very largely held, but there is reason to believe that some important new orders for marine engines and turbines will soon be placed with the Barrow firm.

The Furness Railway Company are ordering a new tug boat of considerable power and also a large steam barge, and it is believed the order for these vessels will go to Vickers, Sons & Maxim.

Shipbuilding Material.—The demand for shipbuilding material is not brisk, and the local mills are only employed on half-time. The local demand is especially slow, but some good business comes from Belfast and elsewhere. Ship plates remain at £7 15s. per ton net cash. Steel castings are in small request, and forgings are in limited demand.

West Cumberland.—The shipbuilding trade in West Cumberland is fairly well employed both at the Workington and the Maryport yards. The shipyard at Maryport, lately in the occupation of the late Mr. W. Walker has been fitted up as an engineering works and in future will be known as the Solway Engineering Works.

Preston.—There is every prospect that the shipbuilding works of the Caledonian Shipbuilding Company at Preston will soon be closed. About three hundred of their men have already been paid off, and unless a new purchaser is found it is evident that this particular industry at Preston will wink out altogether. The works were established 30 years ago by Mr. Allsopp who afterwards formed a limited company, and a gentleman trading as the Caledonian Engineering Company took over the place in February, 1904. In July last he executed a deed of assignment in favour of his creditors, and Mr. James Todd, chartered acountant, was appointed trustee. Since the works were started some three years ago a number of steamships have been turned out, these including the *Santa Cruz* for South America, the *Lake of Shadows* for the north of Ireland, the *Moruya* for Sydney, the *Inauhiny* for Brazil, and the *Marcilio Diaz* for Brazil. When the deed of assignment was executed the *Oceano* for South Africa, and the *Liverpool*, a ferry boat for the Birkenhead Corporation, were on the stocks. They have since been launched, and have been sent to Liverpool to be completed. At one time the firm had as many as 500 men employed.

Hematites.—The hematite trade is strong, although warrants are depressed at 72s. per ton compared with 82s. asked by makers. Stocks are just under 76,000 tons.

Shipping.—The shipments of pig iron and steel this year have been large. They total at 128,242 tons, compared with 91,871 tons, an increase on the corresponding period of last year of 36,371 tons.

BELFAST.

(From our Own Correspondent.)

ACTIVITY is apparent on all hands in connection with the shipbuilding trade on the Lagan, both in the yards and at the fitting-out wharves. The local shipbuilders are secured against slackness for some time to come, for, in addition to the considerable volume of work at present in progress, several of the enquiries referred to in last month's notes have resulted in business.

One of the most important contracts recently fixed with Messrs. Harland & Wolff is that for a 14,000 tons twin-screw steamer for the Dominion Line. This vessel is intended for the company's Liverpool and St. Lawrence service, and the accommodation and conveniences for large numbers of first, second and third-class passengers will leave nothing

to be desired. A special feature which will appeal to comfort-loving travellers will be the first-class sleeping apartments, not more than two passengers being berthed in one state-room. The second-class passengers will be quartered in two, three and four-berth rooms; and small state-rooms will also be provided for a considerable proportion of the third-class passengers. It has been stated that the new Hamburg-American liner, which is to be built at the Queen's Island, will be named *Europa* and is to be of larger dimensions than the leviathan *Amerika*. Her speed will be 19 knots, and she will carry a crew of 500, and 4250 passengers. Tenders are being, or will shortly be invited by the Anglo American Oil Company for three large steamers. As already stated in a previous issue an oil tanker and a barge of big dimensions are at present building at the Queen's Island for this concern. On the 31st January there was launched from the Queen's Island the steel screw steamer *Fulani*, which is the third of four similar vessels ordered from Messrs. Harland & Wolff by Messrs. Elder, Dempster & Co. The *Prahsa*, the fourth of the quartette, will shortly be put in the water. Particulars of these vessels have already appeared in the Marine Engineer. A new twin-screw mail and passenger steamer for the Royal Mail Steam Packet Company, which is being built in the south end of the yard, is about ready for launching. In addition to the extensive alterations to the Orient Royal Mail liner *Oruba*, Messrs. Harland & Wolff have the Belfast Steamship Company's steamers *Optic* and *Caloric* in hand for repairs and overhaul. These vessels have been out of commission since the advent of the company's new twin-screw steamers *Heroic* and *Graphic*. A model of the White Star Company's Australian liner *Suevic*, now being exhibited in the Liverpool Polytechnic and Industrial Exhibition, has been awarded a complimentary diploma. The *Suevic* is the largest steamer sailing between the United Kingdom and Australia.

Messrs. Workman, Clark & Company have received from the Royal West India Mail Company, Amsterdam, an order for the construction of two fruit steamers for the company's trade between the West Indies and New York. The dimensions of the vessels will be:—Length, 336 feet; beam, 42 feet; depth, 26 feet; with a deadweight of 2530 tons. Accommodation will be provided for 50 first-class passengers. The speed is to be 13 knots, and the vessels are to be delivered early next year. Messrs. Workman, Clark & Company have had considerable experience in the building of this type of vessel during the past few years, and are thoroughly conversant with the requirements of the trade. Other important orders have been secured by Messrs. Workman, Clark and Company within the last month or so, and they are provided with work for a good while to come. During the month of February they have completed and handed over to their respective owners the City liner *City of London*, and the Elder, Dempster liner *Salaga*. The former vessel, which has a length of 507 feet and gross tonnage of 8800 tons, underwent a most successful trial in Belfast Lough on the 2nd of the month. The machinery consists of a set of quadruple expansion engines with auxiliaries of the latest type, steam being supplied by four large boilers working at a pressure of 215 lbs. per square inch, under Howden's forced draught. The *Salaga* is 395 feet long, with a gross tonnage of 3800 tons. This steamer had an equally successful trial on the 12th of the month. Within a few days of writing Messrs. Workman, Clark & Company will launch a new steamer named *Chyebassa*, which they have constructed for the British India Steam Navigation Company. This vessel was to have been launched on the 14th curt., but after moving a few feet she remained fast, and all efforts to float her proved unsuccessful. Owing to the severe weather at the time, the lubricants had frozen on the ways, and this, it is believed, was the cause of the hitch. They will also shortly launch a twin-screw passenger steamer for Rio Janeiro named *Ceara*. Messrs. Workman, Clark & Company have a fair amount of repair work in hand at present, including the making good of the very extensive fire damage on the Houlder liner *Beacon Grange*.

Since writing these notes, the British India Steam Navigation Co.'s *Chyebassa* above referred to, has been successfully launched. The new steamer is 445 feet long with a gross tonnage of about 6000 tons. The launching ceremony was witnessed by the Lord Mayor and Lady Mayoress (the Earl and Countess of Shaftesbury).

JUNIOR ENGINEERS.

VI.*

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Mouldings *(continued)*

THE physical properties of a good moulding sand are refractoriness, porosity and binding power; these to a large extent are dependent on the chemical composition of the material, the natural or green sand being principally a mixture of oxides of silicon, and the metals aluminium, magnesium, calcium and iron. Silica, Si. O_2, the oxide of silicon, is the most refractory material suitable for moulding, and is present to the extent of from 85 to 90 per cent., above this the cohesion of the sand is lost, and the mould will crack in drying. Alumina, $Al._2 O._3$, aluminium oxide, may be in the proportion of 6 or 8 per cent., but a larger amount is detrimental to the sand, as it tends to vitrify at high temperatures. Magnesia, Mg-O., magnesium oxide, contributes 1 to 2 per cent., above this percentage the porosity of the sand is endangered, although the refractoriness is rather improved. These latter two constituents are useful as binding agents for the silica, above 10 per cent. however, the sand may be too strong, hard to work and of reduced porosity, as, together with water, clay is formed, a hydrated silicate of alumina, $Al._2 O._3, Si. O._2, 2H._2 O$. These three oxides form the basis of the moulding material, the other substances occurring as impurities.

Lime, Ca.O, calcium oxide, is detrimental to the refractoriness of the sand, as although infusible in itself, it is not so in presence of silica, hence the proportion should not exceed ½ per cent.; lime may also be present as calcium carbonate, $Ca.C.O._3$, especially in sands obtained from the chalkm easures.

Iron Oxide, Fe.O, also tends to make the sand fusible, and should not be above 4 per cent.; iron is frequently to be found in combination with sulphur as pyrites, $Fe. S._2$, and this adds to the evil.

The hydrates and chlorides of sodium and potassium also occur in small proportions, and as even the least traces of these are objectionable they should be washed out with water.

Although a chemical analysis is important in determining the nature of the sand, the physical properties are equally so. If the sand is not sufficiently refractory the crystals will fall to powder owing to their inability to resist the burning action of the hot metal. If the crystals have had their sharp corners rounded off in passing through the mill, the sand will lack cohesiveness, this may be tested under the microscope. With too large a proportion of clay the sand will not be sufficiently porous to allow of the escape of the hot gases generated in the mould, this porosity being estimated by taking the Sp. Gr. of the sand when perfectly dry, and when saturated with moisture. The other chief characteristic is the fineness of the grain or size of crystals, the sand taken from the mill being passed through sieves and the fineness expressed in terms of mesh per sq. inch. Sands approximating to the foregoing compositions are found in several districts, those from the Thames basin at Erith, and from Belfast, being among the best, these latter are specially suitable for light castings, and for heavy work are strengthened by the addition of fireclay to Erith, and rotten rock sand to Belfast.

Moulding methods are divided into three classes according to the material employed, these are green sand, dry sand, and loam, with further sub-division according to the type of casting and style of moulding.

Green sand is used, with little preparation, just as taken from the pit, water being added to keep it sufficiently damp, this is usually done each day before using. The sand that is placed next to the pattern, as distinguished from that which goes to fill up the moulding box, is termed facing sand, and is a mixture of the new sand with about twice its bulk of the same material which has been used several times, and termed

* For Articles I. to V., see last five issues.

old or floor sand, being taken from the foundry floor merely to economise the importation of fresh material. Into this mixture 10 per cent. of coal dust is riddled, the whole being intimately shaken together and sprinkled with water. The coal dust imparts openness of texture to the mould, and the hot metal coming in contact with the coal burns it out with the evolution of gases which form a protecting medium for the sand, preventing any fusion which might take place and giving a smooth surface to the skin of the casting.

Dry sand is so termed because the mould, being formed from the wet material, must be thoroughly dried in the stove before pouring. The composition varies greatly according to the sand employed; for facing, a mixture of rock sand and dried loam, and for filling up, the sand from the floor may be added, coal dust being mixed in with the facing sand as before.

For brass castings, however, neither rock sand nor coal dust should be used, as the surface will be roughened with green sand moulds; but for dry sand a mixture of old and new rock sands may be advantageously used in the general class of work. All intricate moulds for brass and also ornamental castings are done in green sand, the best material for this purpose being the red Belfast sand.

Loam, a mixture of clay and sand, is used in a condition resembling mud, and to give the requisite porosity various materials are added, such as chopped straw, bran, cow hair, coal and coke dust, these being churned up in the mill and mixed with water before using, the mould being thoroughly dried as with dry sand. In building up large loam moulds, brickwork is extensively used, the loam facing being plastered on, to make up the mould, for a thickness of an inch or so; the bricks employed are softer than ordinary building material, being less burnt, and bricks made of sand and straw mixed with clay water are also used, these latter soft enough to be pared down with the trowel.

Wherever there is a division in the mould, as between the upper and lower boxes, or cope and drag, provision must be made to ensure a clean parting. For this purpose parting sand is employed, the physical properties of which are that it must not absorb moisture and be incapable of forming an adhesive mixture; burnt sand from castings, well-baked green sand, brick dust, clean dry sand, and powdered blast furnace cinder are all employed, whichever is most readily obtainable; these are ground to a very fine state of division and sieved over the mould.

The material from which cores are made differs somewhat from the mould. In green sand work the cores are baked in the stove, hence a binding material is necessary which will still leave the core porous and weak enough to permit of the free passage of the gases; for light work the green sand is mixed with weak sharp sand and moistened with water or a core gum solution made from potato starch, barm or peasemeal; heavy cores may be strengthened by the addition of loam.

Dry sand cores are formed with rock sand and old dry sand, clay water being added to strengthen the material; these are stove dried, as are also the loam cores; the loam used for core making is a mixture of the facing loam with sawdust or other such materials; these, when the core is stoved, are burnt out, thus giving the necessary openness of texture; charcoal is frequently mixed in with intricate cores in order to allow of greater facility in removing from the casting.

To protect the sand on the face of the mould from the hot metal various blackings are used, with the same object and result as explained in reference to the coal dust in green sand; this coal dust is further aided by sifting powdered charcoal over the mould from a bag, oak charcoal is the best owing to its greater weight per bulk, but is more expensive than other woods.

Dry sand and loam moulds and cores are coated by means of a soft brush or swab with a mixture of clay water, of a creamy consistency, and ground charcoal, paraffin coke, gas works char, coal or coke dust, this paste being dried thoroughly before pouring the metal.

The high temperatures of steel castings require a much more refractory material than is necessary for iron or brass, and the great pressure which is put upon the mould by the contraction of the cooling metal requires that the sand must be sufficiently weak that it will give to this pressure. Infusible quartz sand is mixed with a highly refractory clay and coal dust, water being used as a binding agent. A highly ferruginous clay is also used with a small percentage of graphite. The mould is thoroughly dried and the composition sets hard.

The blacking applied is either liquid black lead or graphite, both for moulds and cores.

OBITUARY.

David MacBrayne.—By the death of Mr. David MacBrayne, shipowner, which took place at his home in Glasgow on the 26th January, Glasgow has lost a citizen whose name has for four decades been a household word in the Western Highlands and Islands of Scotland, and indeed over a much wider area. The fleet of handsome river and coasting steamers—well known units being the *Iona* and the *Columba*—which up till some little time before his death was under his ownership and control, has been instrumental more than any other factor in opening up the romantic regions of the Western Highlands and Islands, in developing their natural resources, and in making them the resort of the sportsman and the yearly increasing multitude of tourists from all parts of the world. Deceased, who had reached the advanced age of 92 years, had been in feeble health for some time, and his demise, therefore, was not unexpected. He came of an old Glasgow stock, his father having filled the position of Registrar in the Barony Parish and his mother being the daughter of Rev. Dr. Burns, of the Barony church. He was thus a nephew of the founder of the Cunard Company and a cousin of the first Lord Inverclyde. In early youth Mr. MacBrayne followed the occupation of a typefounder, but soon abandoned it, and entered a shipping office, where he acquired the experience for the important work to which his later years were devoted. He was from the first associated with David and Alexander Hutchison, founders of the shipping service to the West Highlands, including the "Royal Route" (so named after the well-known journey of the late Queen Victoria) from Glasgow to Ardrishaig through the Crinan Canal to Oban, Staffa and Iona. In 1876 Mr. David Hutchison retired from the firm, and two years later his brother also withdrew, leaving Mr. MacBrayne the sole partner. About that time the fleet consisted of 15 steamers with a gross tonnage of 3380 tons; now it embraces 34 steamers of close on 11,000 tons. In 1902 Mr. Macbrayne took into partnership his two sons, Mr. David Hope MacBrayne and Mr. Lawrence MacBrayne, who, having had enginering as well as commercial training, ably and enterprisingly assisted in the up-keep and development of the fleet and service. In 1905 Mr. MacBrayne, senior, retired from active control, and the business was formed into a limited liability company, with his eldest and first-named son as chairman and managing director. Deceased in his younger days took an interest in volunteering and rose to the rank of Major. For a number of years he was a member of the Clyde Navigation Trust, and he was a Justice of Peace for the city of Glasgow and the county of Lanark.

Shaft Breakage and Repair at Sea.—When on a voyage from Glasgow to Newport News, several weeks ago, the Donaldson liner *Hestia* broke her thrust shaft. Mr. Angus A. Urquhart, chief engineer, has furnished to the last monthly report of the Marine Engineers' Association some interesting particulars as to how repairs were effected and the machinery made good for the return to Glasgow. The thrust shaft was 21 ft. long, collars 22½ in. diam. and body of shaft 13¾ in. diam., thickness of collars 3⅜ ins. The shaft was completely broken, and was repaired by drilling three 1⅝ in. holes in collars, and recessing one collar to receive the heads of the bolts so as to clear the thrust webb. After fitting the 1⅝ in. bolts in collars, three keys were also fitted on edge of collar, two of them 14 in. by 5 in. by 1⅜ in.; one made from the shank of a 3¾ in. spanner, being 14 in. long and ⅝ in. thick. Securing the shaft (which took 48 hours), and drilling the holes and cutting one key seat was accomplished under very trying circumstances. A furious gale was raging, and the ship drifted 256 miles in five days. When anchors were dropped outside Loop Head, Ireland, the repairs were completed, and the vessel steamed to Greenock, *en route* for Glasgow, a distance of 367 miles, which was accomplished in 47 hours 21 minutes.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Velocity.—On January 29th, Messrs. J. Scarr & Son launched from their Beverley yard a steel keel, built to the order of Mr. C. Kates of Hull. The vessel, which was christened the *Velocity* by Miss Georgiana Kates, daughter of the owner, has a carrying capacity of 170 tons and is of the following dimensions: length, 74 ft. 6 in.; beam, 15 ft. 4 in.; depth, 8 ft.

Norfolk.—On January 31st there was launched from the yard of the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, the fine steel screw steamer *Norfolk*, built for Messrs. Furness, Withy & Co., Ltd., of West Hartlepool. The steamer is 360 ft. long by 50 ft. beam by 27 ft. 6 in. deep and has been built under special survey to the highest class at Lloyds, three deck rule, single deck type. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation, which is very ample, being all placed in steel houses on the bridge deck. This steamer has been specially designed with a view to rapid loading and discharging of homogeneous cargoes, the hatchways being very long and wide and are arranged for grain carrying in bulk. Ample deck gear is provided, consisting of 9 steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, steam steering gear by Messrs. J. Hastie and Co., and steam windlass by Messrs. Emerson, Walker and Thompson Bros. She is of course fitted with the usual water ballast arrangements for light passages. She has been constructed to a fine model with a view to rapid speed and economy in fuel, and the machinery will be supplied by Messrs. George Clark, Ltd., Sunderland, consisting of engines with cylinders 24 in., 40 in., and 67 in. by 45 in. stroke; two large steel boilers 16 ft. by 10 ft. 6 in., 180 lbs. pressure. The steamer will carry 6,600 tons loaded on a light draught and is expected to steam about 10 knots.

Snestad.—On January 31st there was launched from the Southwick Yard of Messrs. Robert Thompson & Sons, Ltd., a single deck steamer, built to the order of Messrs. A. F. Klaveness & Co., of Sandefjord. Her principal dimensions are, length B.P., 299 ft., breadth, 44 ft. 6 in., depth moulded, 22 ft. 3 in. She is classed 100 A1 at Lloyds and is built on the deep frame principle with one deck, leaving the holds clear of all obstructions. The erections consist of poop 25 ft., bridge 74 ft., both available for cargo if required, and topgallant forecastle for the accommodation of petty officers and crew. There are large and spacious deck houses on top of bridge deck for captain, officers and engineers, the saloon being fitted up in polished oak. There are four large hatchways, each worked by a powerful steam winch for the rapid loading and discharging of cargo, with multitubular donkey boiler, quick warping steam windlass and steam steering gear. The engines are by Messrs. Geo. Clark, Ltd., of Sunderland, of the triple expansion type, having cylinders 21½ in., 36 in., and 59 in. by 39 in. stroke, with extra large boilers of 180 lbs. pressure. During construction the vessel and her machinery have been personally superintended by Mr. A. Nicol, of Sunderland. As the vessel left the ways, she was gracefully christened *Snestad* by Mrs. J. L. Thompson. On returning to the offices, where light refreshments were partaken of and the usual toasts proposed and responded to, Captain Raastad, on behalf of the owners, very kindly presented Mrs. Thompson with a lovely bouquet of roses and handsome silver rose bowl as a souvenir of the occasion.

Sygna.—On January 31st, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesborough, a steamer built with Cantilever frames on Harroway & Dixon's, John Priestman's and Livingston & Sanderson's patents, to the order of Herr J. Ludwig Howinckel of Bergen. She is being built to highest class at Norske Veritas and 100 A1 at Lloyds, her leading dimensions being 372 ft. 2 in. by 52 ft. by 28 ft. 4 in. moulded and she will carry a deadweight cargo of over 7,400 tons on 23 ft. 7 in., with four exceptionally large hatchways, 36 ft. long and 30 ft. wide, and perfectly self-trimming and unobstructed holds. The vessel will be equipped with 10 powerful steam winches, 8 derricks, hand and steam steering gear and will have 6 water-tight bulk-heads, 4 boats, etc., and all the latest and most modern appliances for the rapid handling of cargo. In addition to this, the vessel will carry an unusually large quantity of water ballast, located under the deck in topside tanks, as well as in the double bottom and peaks. She will be fitted with engines by the North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 26 in., 42 in., and 70 in. by 48 in. stroke, supplied with steam by 3 large single ended boilers, working at 180 lbs. pressure and fitted with Howden's System of Forced Draught. The engines will be placed aft in vessel. Wailes, Dove & Co.'s bitumastic enamels were applied to bunkers and side ballast tanks and bitumastic covering to the tank top in boiler room. On leaving the ways she was gracefully named *Sygna* by Miss Houston, the daughter of Mr. J. Houston of Sunderland. The vessel and her engines are being built under the superintendence of Mr. Houston and Captain Olsin, who will also command the ship.

Daisy.—On February 9th there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Ltd., at Bill Quay, Newcastle-on-Tyne, a new steel screw steamer, which has been constructed to the order of Mr. Martin Carl, of Copenhagen. The vessel is a sister ship to the ss. *Vera*, recently built by them for the same owner, and is of the single-deck type with poop, long bridge and topgallant forecastle. Water ballast is provided in the cellular double bottom all fore and aft and in the fore and after peak tanks. The saloon, captain's accommodation, etc., is arranged in the poop aft, the officers and engineers being berthed in sidehouses under the bridge and the crew in the topgallant forecastle. The vessel will be rigged as a two-masted schooner and will be fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo. The machinery, which is of the improved triple-expansion type, supplied with steam by a large steel multitubular boiler, has been constructed and will be fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne. Both the ship and engines have been built to the requirements and under the special survey of Lloyds for their highest classification and have also been superintended during construction by Captain Lagesen, on behalf of the owner. As the vessel left the ways, the christening ceremony was gracefully performed by Miss Daisy Hopkirk, daughter of Mr. David T. Hopkirk, of Newcastle-on-Tyne, who named her *Daisy*.

Trecarrell.—On Febraury 11th, a new screw steamer named the *Trecarrell*, built to the order of the Hain Steamship Co., Ltd., St. Ives, was launched from the Shipbuilding Yard of Messrs. John Readhead & Sons, West Docks, South Shields. The vessel is of the improved single deck type to Lloyds' highest class, and designed to carry 6,700 tons deadweight on a moderate draught, having a cellular double bottom all fore and aft, and fitted with poop, long bridge and top-gallant forecastle. Steel houses for captain and officers and also for engineers and apprentices are constructed on the bridge deck, the crew being berthed in the forecastle. The vessel is also fitted up with grain feeders in accordance with the Grain Cargoes Act. The vessel will be fitted with triple expansion engines, also constructed by Messrs. John Readhead & Sons, having cylinders, 25 in., 42 in., and 68 in. by 45 in. stroke, supplied with steam from two large steel boilers working at a pressure of 180 lbs. per square inch. This is the 49th vessel built for the above firm by Messrs. John Readhead & Sons.

Komata.—On February 12th, the s.s. *Komata*, which is being constructed by Swan, Hunter & Wigham Richardson, Ltd., was launched from the Neptune Works, Newcastle-on-Tyne. The steamer is 295 ft. in length by 42 ft. beam and will carry 3,100 tons deadweight on a light draught of water. She is being built under the survey of the British Corporation and will be rigged as a schooner. She will be propelled by a set of triple expansion engines which, with their boilers, are being constructed by Swan, Hunter & Wigham Richardson, Ltd., and are expected to maintain a speed of 10½ knots when the vessel is fully loaded. At the launch, the owners, the Union S.S. Co., of New Zealand, Ltd., were represented by Mr. J. R. Campbell, of Glasgow, and Mr. Wallace, their superintending engineer, and the christening ceremony was gracefully performed by Miss Paterson, daughter of Mr. R. Paterson, under whose superintendence the steamer is being constructed.

President.—On February 12th, Messrs. S. P. Austin & Son, Ltd., launched from their shipbuilding and repairing establishment at the Wear Dock Yard, Sunderland, the steel screw steamer *President*, which has been built to the order of Mr. James Westoll, of Sunderland. She is designed to carry about 3,000 tons deadweight, will be classed 100 A1 in Lloyds' Register under special survey and is specially adapted for quick loading and discharging coal cargoes. Accommodation for captain and officers is provided in the poop, engineers in Bridge House and crew in forecastle. Ample water ballast capacity has been provided for. The machinery will be supplied by Messrs. John Dickinson & Sons, Ltd., Wailes, Dove & Co.'s bitumastic enamels were applied to the lower bunkers and their bitumastic covering to the tank top in boiler room. Deck machinery, including Steam Windlass, by Emerson Walker & Thompson Brothers, Limited. Steam Winches by John Lynn & Co., Limited. Steam Steering Gear by Donkin & Co. Blake Donkey Boiler, etc.

Fitzclarence.—On February 14th, Messrs. R. Craggs & Sons, Ltd., launched from their Tees Dockyard, Middlesborough, a fine steel cargo steamer, 390 ft. long, 52 ft. 3 in. beam, 28 ft. depth moulded. This vessel is being built to take the highest class under Lloyds' strengthened spar deck rule, with two decks laid, having poop, bridge and forecastle. Accommodation is provided for captain in deck house on bridge, and for officers and engineers under bridge, and the crew in the forecastle. Cellular double bottom is fitted throughout for water ballast, which is also carried in after peak and deep tank amidships, the total capacity being about 1,900 tons. Nine powerful steam winches are provided of the most approved type. Steam steering gear is supplied and improved quick warping steam windlass is fitted forward. The arrangements for handling ship and cargo are most complete in every respect and the design contemplates the carrying of about 7,200 tons on a very light draught with a speed of 10 knots. The machinery will be fitted by the North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne, and will have cylinders 25 in., 41 in., 68 in. by 48 in. stroke, steam being supplied by three large single ended boilers, working at 180 lbs. to the square inch. The vessel has been built to the order of Messrs. Burrell & Son, of Glasgow, and on leaving the ways was named *Fitzclarence* by Mrs. E. Hall Craggs. The specifications have been supervised and the construction of the hull and machinery has been carried out under the superintendence of Mr. J. C. Stewart, assisted by Mr. D. Millarbas, resident surveyor.

Orlando and Vidonia—On February 14th there were launched from the shipyard of Messrs. Cochrane & Sons, Shipbuilders, Selby, two handsomely modelled steel screw trawlers, the principal dimensions being 128 ft. by 22 ft by 13 ft. 10 in. moulded. The vessels have been built to the order of Messrs. The Dolphin Steam Fishing Co., Ltd., and Messrs. The Arctic Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. Amos & Smith, of Hull, and are replete with all the latest improvements for fishing purposes. As the vessels left the ways they were gracefully christened the *Orlando* and *Vidonia* by Mrs. E. Bacon of Grimsby, wife of the managing director of the companies, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Penrice Castle.—On February 14th, there was launched from the shipbuilding yard of Mr. William Walker, Maryport, a finely modelled steam trawler of the following dimensions: length, 120 ft.; breadth 22 ft.; depth moulded, 12 ft. 8 in. The vessel is fitted with all the latest improvements for fishing vessels, including a whaleback-forecastle and insulated fish hold. She will be fitted with machinery by Messrs. MacColl and Pollock, Sunderland. The vessel was named *Penrice Castle* by Miss Temple, Ellengrove, Maryport.

Rotterdam.—On February 14th, an important launch took place from the yard of the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, the vessel being the fine steel screw steamer *Rotterdam*, which has been constructed to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, for their Rotterdam-Baltimore Line. The vessel has been specially designed for this trade, and she is fitted with all the latest improvements and up-to-date appliances to make her in every way a first-class liner. She is 425 feet in length with three complete steel decks, including the shelter deck all fore and aft, with a cargo-carrying capacity of over 13,000 tons. Over 2,000 tons of water ballast is carried in the cellular bottom of increased height, also large deep tank fore and after peak, which, with the bunkers, will put the vessel in excellent trim irrespective of cargo. The shelter 'tween deck is of exceptional height, and is arranged so that a large number of emigrants can be carried. The saloon accommodation is placed on top of shelter deck, the heating is by steam. Loading and discharging facilities are considerably in excess of what is usual. This steamer has 22 derricks and winches to ensure the most expeditious handling of cargo, a special feature being that the steamer is fitted with a perfect system of mechanically circulated air ventilation with Elwine's patent ventilator cowls, so that provisions and merchandise of a perishable nature can be carried without risk of deterioration. An electric light installation is fitted throughout the vessel. The vessel has been built to a fine model and to include the most modern improvements. The machinery has been specially designed and constructed by Messrs. Richardsons, Westgarth & Co., Ltd., with extra large high pressure boilers fitted with Howden's forced draught to attain a speed of over 13 knots laden. Mrs. Stephen W. Furness gracefully performed the christening ceremony, naming the vessel, *Rotterdam*.

Dago.—On February 16th, Messrs. J. Scarr & Son launched from their Beverley yard a steel lighter, built to the order of Mr. Robt. Lancaster, of Hull. The vessel, which was christened *Dago*, has a carrying capacity of 180 tons and is of the following dimensions: length, 67 ft.; beam, 18 ft.; depth, 8 ft. 6 in.

Leander.—On February 16th there was launched from the shipyard of Messrs. Cochrane & Sons, Shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 128 ft. by 22 ft. by 13 ft. 10 in. moulded. The vessel has been built to the order of Messrs. The Lindsey Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. Amos & Smith, of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Leander* by Mrs. E. Bacon, of Grimsby, wife of the managing director of the company, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Onward Ho.—On February 16th the handsomely modelled steam trawler *Onward Ho*, built to the order of Messrs. S. T. White & Co., Ltd., Hull, was launched from the yard of Earle's Shipbuilding and Engineering Co., Ltd., Hull. The dimensions of the vessel are: length, 143 ft., 4 in.; breadth, 23 ft.; depth, moulded, 13 ft. 4 in. She has been built under Lloyd's Survey for 100 A1 class steel, and is intended for the Iceland trade. The vessel is fitted with a whaleback specially constructed to encounter heavy weather and provide a shelter for the deck hands forward. A departure has been made from the usual arrangement of cabin aft, the mess room and pantry being located in a deck house continuous with the galley, and having four separate rooms below the quarter deck for sleeping accommodation. The engines and boiler will be supplied by Messrs. Amos & Smith, Hull. The naming ceremony was performed by Miss L. A. Langley, and amongst those present were Mr. White, managing director, Mr. W. Gemmell, Mr. Langley and Mr. F. Somerscales (Earle's Co.).

Regulus.—On February 16th, there was launched from the Wallsend yard of Swan, Hunter & Wigham Richardson, Ltd., a steel screw steamer which has been built to the order of the Westport Coal Co., Ltd., of New Zealand. The vessel has been designed for carrying coal from Westport to Wanganui and to carry her cargo on an exceptionally light draught of water in order to negotiate the bar at the latter port. The vessel is of the following leading dimensions, *viz.*, length overall, 178 ft.; beam extreme, 29 ft. 10 in. and depth moulded, 11 ft. 8 in. The machinery has been constructed by Messrs. A. G. Mumford, Ltd., of Colchester, and consists of two sets of compound engines driving twin screws, steam being supplied by two large single-ended boilers, 120 lbs. pressure, which are expected to drive her at a speed of 11 knots on a loaded trial trip. This is the second vessel that has been built by the same builders for the same owners recently. The vessel has been

built under the supervision of Captain Lobb and Mr. Wm. Cairns, the owners' superintendents. On leaving the ways, the vessel was gracefully named the *Regulus* by Miss Deans, of Whitley Bay.

Lagos.—On February 12th, Messrs. W. Harkess & Son, Ltd., of Middlesborough, launched a finely modelled steamer which they have built to the order of Messrs. Elder Dempster and Co., for their mail and passenger Bar Service at Lagos. The dimensions are 177 ft. long by 26 ft. beam, and she is designed to sail on a draught of under 8 ft. when fully loaded. Handsome accommodation for a limited number of passengers will be furnished in the poop and amidships, and she will be fitted with engines by Messrs. MacColl & Pollock, capable of driving the vessel at a speed of 11 knots. On leaving the ways she was christened *Lagos* by Miss Norah Harkess, of Levenside, Stokesley.

LAUNCHES—Scotch.

Randova.—On January 26th a sailing vessel of an unusual type, named the *Randova*, was launched from the yard of Messrs. Napier & Miller on the Clyde. The *Randova* has been built to the order of Messrs. Lever Bros., Limited, of Port Sunlight. She has been specially designed for the conveyance of oil in bulk or general cargoes and will carry about 2200 tons on a light draught of water. The vessel is 230 feet long with a beam of 37 feet. She has been fitted with 9 bulkheads as well as a fore and aft, divisions in oil space forming 10 oil compartments in addition to general cargo, upper decks and forehold and two peaks. A large boiler has been fitted with feed and general donkey pump, also two powerful duplex double acting pumps for dealing with oil cargoes, which can be rapidly discharged. She is equipped with steam winch for working general cargoes and windlass and capstan for handling the vessel. A fresh water condensing plant and exhaust tank has also been fitted. The crew are housed in the forecastle and the captain and officers in the poop. Room has also been provided for apprentices. She has been built to the specification and under the superintendence of Messrs. Flannery & Given, of Liverpool, London and Rotterdam.

Walton Hall.—On January 30th the *Walton Hall*—the latest addition to the Hall Line—one of the various lines included in the Ellerman Lines, Limited—was successfully launched. The steamer is one of a large number of similar vessels built during the last few years to the order of Sir John Ellerman, Bart., many of which have been built by Messrs. Barclay, Curle & Co., Limited, of Glasgow, but, being the latest, she naturally possesses many points of superiority which the experience gained on her earlier sisters has shown desirable; and she can be considered as being a favourable example of a high-class modern carrying liner. She is built to scantlings in excess of the British Corporation requirements for their highest class, and her dimensions are: Length overall, 413 ft.; breadth extreme, 50 ft. 3 in.; depth moulded, 32 ft. 3 in. She carries the large deadweight of 8300 tons on a moderate draught, with a low register tonnage, and as no passengers are carried, no restrictions exist to prevent the arrangements for carrying, stowing, loading and discharging cargo being, as they are, the best that experience can suggest for her intended service to India. The machinery, constructed by the builders, consists of one set of triple expansion engines with boilers of ample power fitted with Howden's Forced Draught, and designed for a speed on service of 11 knots.

Voltaire.—On January 31st there was launched from the shipbuilding yard of Messrs. David and William Henderson & Co., Limited, Partick, the large screw steamer *Voltaire*, which they have built to the order of Messrs. Lamport and Holt, Liverpool. The vessel, which is of the following dimensions:—Length overall, 501 ft. 6 in.; breadth moulded, 58 ft.; depth moulded, 29 ft., is classed in the British Corporation B.S., and is of about 8100 tons gross register, to carry about 11,000 tons deadweight. She is provided with a Board of Trade Passenger Certificate, having accommodation for 60 first-class passengers, comprising state rooms and saloon on upper deck and state rooms and smoking room on promenade deck amidships. For the second-class passengers accommodation is fitted aft in poop on main deck, comprising saloon, state rooms and smoking room. Captain's, chart-room and officers' rooms are placed on flying bridge, while the engineers are accommodated in aft end of amidships house on upper deck; seamen and firemen are berthed in forecastle. The vessel, which has been specially constructed to suit the owners' South American trade, is intended to carry a large number of cattle, and is also fully equipped with derricks and 15 steam winches for the rapid handling of large cargoes. She has two steel pole masts, made telescopic to suit the Manchester Canal, and is schooner rigged. Steam steering gear is placed amidships with hand screw gear aft. Electric light is fitted throughout the vessel. The machinery, which is being supplied and fitted by Messrs. Henderson, consists of triple expansion engines, with cylinders 27 in., 46 in., and 77 in. dia. by 60 in. stroke, and three double ended boilers working at a pressure of 200 lbs. The hull has been constructed under the supervision of the owners' superintendents, Capt. Bird and Mr. J. Russell, while the building of the machinery has been supervised by Mr. J. Dall. On leaving the ways the vessel was gracefully named *Voltaire* by Miss Bird, daughter of Capt. Bird, owners' marine superintendent.

Hunter.—On February 2nd Ramage & Ferguson, Limited, launched a very finely modelled steel twin-screw steamer, built to the order of the Newcastle and Hunter River Steamship Company, Limited, Sydney, New South Wales, for their fast passage and light cargo service between Sydney, Newcastle, N.S.W., and the Hunter River. Built to the designs and specifications prepared by the Company's superintending engineer, Mr. J. R. Thomson, to the highest class of the British Corporation, the vessel presents a handsome appearance with great capacity for a high speed on a light draught of water. Her principal dimensions are:—Length B.P., 255 feet; breadth moulded, 40 feet; and depth to awning deck, 22 feet, while above are spacious ranges of deckhouses and passenger accommodation has been provided for 132 first-class and 110 second-class in roomy and well-ventilated state rooms, with a head room of 8 ft., through which air is passed by a system of air pump ventilation. All the furnishings and fittings of the saloons and cabins are of a high-class description, and provide a high degree of comfort for passengers. Eight powerful steam winches provide for the rapid handling of cargo, and electric lighting is fitted throughout, along with a projector searchlight for navigating at night in narrow waters. Two sets of triple expansion engines of 2500 I.H.P. supply power for a sea speed of from 14 to 15 knots, each set having cylinders 17½ in., 28½ in. and 48 in. dia. by 30 in. stroke, steam being supplied by three Babcock & Wilcox patent water-tube boilers of their latest marine type, working at 180 lbs. pressure. A large number of gentlemen connected with the shipping trade of Australia witnessed the launch, previous to which the steamer was named *Hunter* by Miss Ramage, The Hawthorns, Bonnington. The builders afterwards entertained those present to cake and wine in their model room, and success to the *Hunter* and their owners was proposed, along with other appropriate toasts.

Allan.—On February 18th, at Alloa, there was launched from the yard of Mackay Brothers a steel screw steamer 230 ft. by 34½ ft. by 18 ft. 3 in., moulded for the Dampskibsselskabet Ocean Limited, Aarhus, Julius A. Christensen, manager. The vessel is of the raised quarter-deck type, built to Lloyd's highest class, and is intended for the coal trade between this country and Denmark. Triple expansion engines placed amidships are being supplied by Hutson and Sons, Limited, Glasgow, the cylinders being 18 in., 30 in., 48 in. by 33 in. stroke, with large boiler working at a pressure of 180 lbs. During construction the vessel and machinery have been superintended by Messrs. Wallace and Co., of London and Glasgow. The vessel was named *Allan* by Miss Petraca Klovborg, youngest daughter of the Danish Consul, Alloa.

Chikuzen Maru.—On February 18th there was successfully launched from the yard of Messrs. David & William Henderson & Co. Limited, at Partick, a steel screw steamer, which they have built to the order of the Nippon Yusen Kaisha, Japan, through Messrs. A. R. Brown, McFarlane & Co., Limited, Glasgow, and under whose inspection the vessel has been built. The dimensions of the vessel are:—Length between perpendiculars, 310 ft., breadth moulded 40 ft.,

depth moulded 26 ft. 6 in., with a gross tonnage of about 2530 tons. She is built to class 100 A1 Lloyd's spar deck class, and also in accordance with the Teishinsho Rules. Accommodation is provided in state rooms under the fore part of bridge deck for a limited number of first-class passengers, and in addition there is a dining saloon and smoke-room in polished hardwood of a neat and tasteful design. Aft in the poop there is accommodation in rooms for 16 second-class passengers, with dining saloon also in hardwood. Accommodation is provided in forward 'tween decks for third-class passengers. Captain, officers and engineers are berthed amidships and the seamen and firemen forward. Special attention has been paid to the accommodation, all the rooms being large, airy and well ventilated. The vessel throughout is replete with everything that can add to the comfort of passengers and to the economical working of the vessel. The machinery has also been constructed by the builders, and consists of triple expansion engines, having cylinders 25 in., 41 in., and 68 in. dia. by 48 in. stroke, and two large single-ended boilers working at a pressure of 185 lbs. On leaving the ways the vessel was gracefully named *Chikuzen Maru* by Mrs. George McFarlane, Dunsloy, Bellahouston.

LAUNCHES—Irish.

Fulani.—On January 31st Messrs. Harland & Wolff launched the fine steel screw steamer *Fulani* for Messrs. Elder, Dempster & Co., Liverpool. The new vessel is 370 feet long by 49 feet beam and about 4000 tons gross, and has been built to class 100 A1 at Lloyds under special survey. The *Fulani* will have superior accommodation for first and second-class passengers, with smoke-room and saloon. She will have a large deadweight carrying capacity on a light draught, and the arrangements for working the ship and cargo will be of the most complete kind, a special feature being the number of powerful derricks and winches at each hatch. The engines will be triple expansion, and the vessel will have electric light throughout. The owners were represented at the launch by Mr. Campbell.

Chyebassa.—On February 21st Messrs. Workman, Clark and Co., Limited, Belfast, launched from their North Yard a handsomely designed vessel built to the order of the British India Steam Navigation Company, Limited. The launch of this steamer was postponed last week on account of the severe frost, and has since been delayed through the heavy gales which have prevailed during the past few days. The new steamer, named the *Chyebassa*, is 445 feet long with a gross tonnage of about 6000 tons, and has been built under Lloyds' Survey for their highest class; also qualifying for a Board of Trade passenger certificate. Accommodation for passengers is provided in the bridge space, where exceptionally large and well-lighted state rooms are arranged at the side of the vessel, these rooms being fitted with every necessary convenience for the comfort of the passengers. The dining saloon, which is a commodious apartment, is situated in the centre of the vessel with stairways at the after end leading to the promenade deck above. The officers, engineers and petty officers' rooms are placed along the sides at the after end of the bridge space; while the firemen, seamen and servants' quarters, with native galleys and wash-houses, are fitted up in the poop. The cargo space of the vessel is divided into four spacious holes, each of which has a large hatchway centrally placed, and is equipped with a couple of steam winches of the most powerful type, with the necessary derricks swung from the masts and derrick posts, and capable of rapidly loading and discharging cargo. The propelling machinery constructed at Messrs. Workman, Clark & Co.'s Queen's Road Works is of the triple expansion type with all the latest improvements in auxiliaries, and supplied with steam from four steel cylindrical multi-tubular boilers fitted with Howden's system of forced draught. The design and construction of the vessel and machinery have been carried out under the instructions of Commander George Hodgkinson, R.N., Marine Superintendent, and Mr. John Clark, Engineering Superintendent, while the work throughout has been supervised by Mr. Peter Barr, the resident inspector of the Company. The launching ceremony was witnessed by Lord and Lady Shaftesbury.

TRIAL TRIPS.

Rauenfels.—On January 23rd the s.s. *Rauenfels*, which has just been completed by Messrs. Swan, Hunter & Wigham Richardson, Limited, for the Deutsche Dampfschifffahrts Gesellschaft "Hansa" of Bremen, sailed from the Tyne after a very successful trial trip. The steamer is 436 ft. long by 55 ft. 3 inches extreme breadth, and will carry about 8500 tons deadweight. Her engines and boilers have also been constructed by Swan, Hunter & Wigham Richardson, Limited, the former are of the four-crank quadruple expansion type on the well-known Yarrow-Schlick & Tweedy system, and during the trial trip they worked without the slightest hitch, giving satisfaction to all concerned. S. T. Taylor & Sons covered the boilers, pipes, etc., with their "Tynos" covering, and boiler bottoms with their Tynos patent mattresses. The owners were represented on the trial trip by their superintending engineer, Mr. D. Wulff, of Bremen, and immediately on the conclusion of the trial the vessel proceeded on her voyage under the command of Capt. Krippner.

Clearpool.—On January 25th the s.s. *Clearpool* (of which we gave particulars in our January issue, page 236), built by Messrs. Ropner & Son, of Stockton-on-Tees, made her official trial trip in the Tees Bay. The steamer has been built to the order of Messrs. the Pool Shipping Co., of West Hartlepool (Messrs. R. Ropner & Co., managers), and is fitted with the builders' patent improved trunk deck. The engines are of the triple expansion type of about 2100 I.H.P., by Messrs. Blair & Co., Limited, of Stockton-on-Tees. After a very satisfactory trial trip, during which a speed of 11 knots was attained, the steamer proceeded to the Tyne to load. The company on board included Mr. Nicholson, the owner's superintendent, Captain Robinson, the commander of the vessel, and Mr. J. R. Garthwaite, who was in attendance on behalf of the builders.

Westhampton.—On January 25th Messrs. Osbourne, Graham & Co. sent to sea for her official loaded trial the steel screw steamer *Westhampton*, which they have built to the order of the British Maritime Trust, Limited. The steamer has been constructed under Lloyd's Special Survey, and is of the single deck type with poop, bridge and forecastle. She is very fully equipped for her trade, and has most modern appliances for the quick handling of cargo, including donkey boiler by Cochran & Co., Annan, Limited. The machinery is by Messrs. Richardsons, Westgarth & Co., Limited, of Sunderland. S. T. Taylor & Sons covered the boilers, pipes, etc., with their "Tynos" covering. The owners were represented by Mr. Copeman, and on the trial trip everything was to the entire satisfaction of all concerned, the vessel doing a speed of over 10½ knots. After the trial she proceeded on her first voyage to New York.

Myra Fell.—On January 26th, the new steel screw steamer, *Myra Fell*, (of which we gave particulars in our January issue, page 238), built by Irvine's Shipbuilding and Dry Docks Co., Ltd., and engined by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool to the order of Messrs. The Hessler Shipping Co., Ltd., West Hartlepool, proceeded to sea on her trial trip. The vessel has been supplied with a Cochran donkey boiler. After adjusting the compasses, the vessel proceeded to Barrow-in-Furness to load. The following gentlemen were present at the trial: Mr. Jacob Hessler, Mr. Dodsworth, Mr. Cockerill, Mr. Urquhart, representing the engineers, and Mr. A. S. Purdon, the shipbuilders.

Woodburn.—On January 26th, the s.s. *Woodburn*, built and engined by Messrs. The Ailsa Shipbuilding Co., Ltd., of Troon and Ayr, for Mr. C. M. Legg, of Carrickfergus, went on her trial trip, when a speed of over nine knots was attained. The engines worked in a highly satisfactory manner. During construction the vessel and her machinery have been superintended by Mr. Joseph Lewis, of Belfast.

Vera.—On January 28th, the fine steel screw steamer, *Vera*, built by Messrs. Wood, Skinner & Co., Ltd., of Bill Quay on Tyne, left the Tyne for her official trial trip. This vessel, which has been built to the order of Mr. Martin Carl, of Copenhagen, is of the single deck type with poop, long bridge and topgallant forecastle, water ballast fore and aft, on the cellular system and in the fore and aft peak tanks,

to enable her to be put in good trim for light passages. She is also fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo and general working and navigation. The machinery, which has been constructed by Messrs The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple expansion engines, having cylinders 17½ in., 29 in. and 48 in., with a stroke of 33 in., steam being supplied by a large steel boiler working at a high pressure. Despite the very heavy weather on the trial run the engines worked very satisfactorily, and gave great satisfaction to all concerned. Amongst those present were Mr. M. Carl, Junr., Captain Larsen and Mr. Henriksen, who have supervised construction of hull and machinery, Mr. Skinner and Mr. Leslie Skinner, representing the shipbuilders and Mr. J. Daglish, representing the engine builders. After the trial the vessel proceeded to Sunderland to load her first cargo.

City of London.—On February 2nd this new steamer, the latest addition to the well-known fleet of the Ellerman Lines, Limited, proceeded down the Belfast Lough for adjustment of compasses, and speed trials, prior to her departure for Glasgow where she will take cargo and passengers for her initial voyage to India. The *City of London* is the sixteenth vessel built and engined by Messrs. Workman, Clark & Co., Limited, for the City Line Fleet, and is a handsomely modelled steamer 507 feet in length and having a gross tonnage of over 8800. She has been built under the special survey of the British Corporation of Shipping for their highest class, and will fulfil the requirements for a Board of Trade passenger certificate. In designing the vessel special attention has been given to the arrangement of the passenger accommodation. The first-class rooms have been arranged amidships on the upper bridge and promenade decks. The first-class dining saloon at the forward end of the bridge deck is a palatial apartment furnished in oak. The scheme of decoration is quartered oak panelling with relief ornaments of garlands and medallions finished in gold, the ceiling being decorated in white and gold. The furniture includes two handsome library bookcases. The lighting of the saloon is by large cottage windows round the front and sides, having bevelled panes and also a handsomely designed dome through a large well overhead. Convenient to the dining room is the pantry, replete with every necessary and modern appliance for efficient service. Leaving the saloon deck by the handsome oak staircase we reach the entrance hall on the promenade deck. This hall is decorated with an oak dado and upper panels in white and gold, the floor being of artistic rubber tiling, and is lighted by a large skylight. Opening off the forward end is the music saloon, a special feature of which is a handsome alcove dividing the two rooms. The music saloon is luxuriously decorated and furnished. The walls are panelled and relieved with Adams' decorations and small medallion paintings in Bartolozzi style, the whole being finished in white enamel and dull gold. The furniture, including settees, chairs, writing and work tables and pianos is in mahogany, the upholstery being in old rose frieze velvet, with Wilton carpet of pattern to harmonize with the surroundings. The room is well lighted by large cottage windows and also by a large stained-glass dome overhead. At the after end of the entrance hall a number of special cabins de luxe have been fitted up. The promenade deck affords abundant space for exercise and recreation, a number of garden seats being placed in sheltered recesses. The smoke-room, which is placed at the after end of this deck, is very comfortable and commodious. It is panelled and furnished in oak, and has all the necessary comfort of smokers and card parties. The floor is laid with parquetry and abundant light is given by cottage windows and a large skylight. A door at the after end of this room opens into an alcove supplied with seats and tables for the use of those who desire a comfortable lounge in the open air. The state rooms throughout are all exceptionally large and well lighted, a number of them being arranged on the tandem system, while several special cabins have been furnished with brass bedsteads. Special attention has been given to the ventilation of all the cabins, so as to ensure the comfort of the passengers in the hottest climate. The large nursery for the use of the children of first-class passengers is tastefully fitted up and decorated. an interesting feature being the painted panels illustrative of favourite nursery tales and rhymes. A fully equipped gymnasium has been arranged and fitted up under special awnings in the forward well, and will no doubt be fully appreciated by those who are fond of athletic exercise. A plunge bath has been fitted up in the after well. The second class passenger accommodation is divided in the poop. The saloon is placed in the centre of the vessel and is most comfortably furnished. A stairway leads up to an entrance hall with smoking room adjoining in steel house on the poop deck. The floor of these rooms is covered with parquetry, a piano being placed in the entrance hall. The state rooms on the upper deck are all commodious and well lighted, and are replete with every necessary convenience. A barber's shop has been fitted up in the poop close to the deck entrance. The lavatory accommodation throughout is of the most up-to-date character, and includes a number of spray and shower baths. The commissariat departments are admirably arranged, and are provided with the most modern appliances for promptly and efficiently meeting the demands of a full complement of passengers. A cold store with suitable refrigerating plant has been provided for the preservation of provisions and vegetables for the requirements of the passengers during the voyage. The vessel is lighted throughout by electricity, and all the public rooms and state rooms are fitted with electrically driven rotary punkahs, while in the special cabins electric radiators are fitted. An efficient system of steam heating is supplied to the principal public rooms. The cargo space is divided into five large holds, which by the adoption of the girder system of construction are free of obstruction and are capable of receiving the largest type of consignment, such as boilers, locomotives, motor cars and machinery. For the speedy loading and discharging of cargo three and four powerful steam winches are provided at each hatchway, with the necessary derricks swung from the masts and crane posts. A commodious baggage room has been fitted up for the reception of passengers' luggage, and is so arranged that it is always accessible. The bottom of the vessel is constructed on the double bottom system, which, besides adding to the safety of the vessel, is used for the reception of water ballast for trimming purposes. The machinery and boilers consist of a set of quadruple expansion engines with all the latest improvements in auxiliaries, and four steel multi-tubular boilers working at a pressure of 215 lbs. per square inch, under Howden's system of forced draught. The construction of the hull and machinery has been carried out under the supervision of Captain Anderson and Mr. Lang, of the City Line, and of Mr. Alexander Dalrymple, superintendent engineer of the Ellerman Lines.

Manica.—On February 2nd, the steel screw passenger and cargo steamer *Manica* (of which we gave particulars in our January issue, page 236), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesborough, to the order of Messrs. Empreza Naçional de Navegacao, of Lisbon, proceeded to sea for her official trials. Triple expansion engines placed aft have been fitted by the North-Eastern Marine Engine Co., Ltd., of Sunderland. The trials passed off most successfully and the vessel proceeded direct to Lisbon under the command of Captain L. Spencer.

Trelawny.—On February 2nd, the new steamer *Trelawny* (of which we gave particulars in our January issue, page 237), built and engined by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of the Hain Steamship Co., Ltd., St. Ives, was taken to sea on her official trial trip.

Arawa.—On February 4th, the new twin screw steamer *Arawa*, which has been built for the Shaw Savill & Albion Co., Ltd., by Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, was taken out to sea for her trial trip. The *Arawa* is a vessel of the following leading dimensions: length overall, 475 ft., beam extreme, 60 ft. 5 in. and depth moulded to shelter deck, 42½ ft. Accommodation has been provided for 60 first-class and 40 second-class passengers, some of the rooms being interchangeable, and also for about 120 third-class passengers, the latter having two, four and a few six-berth state-rooms. The whole of the accommodation has been designed to give the maximum of comfort to the passengers on the long voyage to New Zealand, the area of all the state-rooms, saloons, etc., being very large in proportion to the number of passengers. The vessel is designed to carry a large cargo of frozen meat, the holds

being insulated for this purpose, and the refrigerating machinery is supplied by Messrs. J. and E. Hall, Ltd., of Dartford. The cargo gear also has had special attention, 13 powerful winches being supplied and 15 derricks, the largest equal to a weight of 30 tons. The machinery consists of two sets of triple expansion engines supplied with steam from four large natural draught boilers, working at a pressure of 205 lbs. per square inch, and these have been supplied by the Wallsend Slipway and Engineering Co., Ltd. This machinery is expected to drive the vessel at a speed of about 13 knots in service. On the trial, everything worked with most perfect smoothness and to the complete satisfaction of the owners' representatives present, who were Captain McKirdy, their marine superintendent, and Captain Scotland, also Mr. G. Adams, their superintendent engineer. Afterwards the vessel sailed for Glasgow to take up her loading berth for New Zealand.

Headley.—On February 9th, the large steel screw steamer *Headley* (of which we gave particulars in our January issue, page 237), built by Messrs. Wm. Gray & Co., Ltd., and engined at the Central Marine Engine Works of the builders for Messrs. Houlder, Middleton & Co., of London, was taken to sea for her trial trip. After adjustment of compasses, the engines were fully opened out, when a maximum speed of 12½ knots and an average of 12 knots was obtained, the performance of the vessel and her machinery being entirely satisfactory. On completion of the trials, the vessel proceeded to Cardiff to load.

Salaga.—On February 12th this new steamer, built and engined by Messrs. Workman, Clark & Co., Limited, Belfast, to the order of Messrs. Elder, Dempster & Co., Liverpool, left the Alexandra Wharf and steamed down the Belfast Lough, and after adjustment of compasses and successful speed trials she proceeded to Liverpool and will shortly be placed on the West African Coast Service. The *Salaga* is 395 feet long with a gross tonnage of over 3800, and has been built under the special survey of the British Corporation of Shipping for their highest class, besides fulfilling the requirements for a Board of Trade passenger certificate. The cargo space is divided into four holds which have been specially arranged for the reception of the largest type of consignments, such as boilers, locomotives and general machinery. The hatchways to these holds are each equipped with two steam winches of the most powerful type, together with the necessary derricks swung from the masts. Excellent accommodation for a number of first-class passengers is provided in the bridge house, all the state rooms being large and well lighted, placed along the sides of the vessel and fitted with every convenience for the comfort of the passengers. The dining saloon situated in the centre of the vessel, is a commodious apartment tastefully decorated and comfortably furnished; a stairway from the saloon corridor, leads to the entrance hall on the bridge deck; this hall has been arranged as a comfortable lounge, and opening off it there is a well-appointed smoke room. Accommodation for second-class passengers has been arranged at the after end of the upper deck, and includes state rooms and a large dining saloon, with the necessary pantry and stewards' accommodation. The officers and engineers' rooms are placed along each side of the vessel, at the after end of the bridge space, while the crew's quarters are in the forecastle space, and include separate mess rooms and wash-houses for the firemen and seamen. The propelling machinery consists of a set of triple expansion engines, having all the latest improvements in auxiliaries, and supplied with steam by three multitubular steel boilers working at a pressure of 205 lbs. The boilers are fitted with Howden's system of forced draught. The construction of the hull and machinery has been carried out under the supervision of Captain Thompson and Mr. Wilkie, marine and engineering superintendents for the Elder Dempster line.

Largo Law.—On February 14th the fine steel screw steamer *Largo Law*, built by Messrs. W. Dobson & Co., of Low Walker-on-Tyne, to the order of Messrs. Law, Leslie & Co., of London, left the Tyne for her official trial. This vessel, which has been built to the highest class at Lloyds, is of the three deck type, with two decks and complete shelter deck laid. The dimensions are 379 ft. between perpendiculars, 50 ft. broad, and depth moulded to upper deck 28 ft., and the vessel has been built on fine lines and with large power, with a view to obtaining a good speed at sea. The propelling machinery, which has been constructed by Messrs. The North-Eastern Marine Engineering Co., Limited, at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple expansion engines, having cylinders 26 in., 42 in., 72 in. by 48 in. stroke, steam being supplied by three large steel boilers fitted with Howden's forced draught system. On the trial run off Whitley, the machinery worked without a hitch, and a mean speed of over 12 knots was attained, which gave great satisfaction to all present, including Mr. Wm. Law, Mr. G. Law, Mr. Leslie, of Messrs. Law, Leslie & Co., Mr. J. Hunter, under whose supervision both hull and machinery have been constructed, Mr. H. and Mr. W. Dobson, representing the shipbuilders, and Mr. D. Myles, representing the engine builders. This vessel, which is a sister ship to the s.s. *Invertay*, recently delivered, is the fourth steamer built by Messrs. W. Dobson & Co. to the order of Messrs. Law, Leslie & Co., all of which have been engined by Messrs. The North-Eastern Marine Engineering Co., Limited, Wallsend.

OBITUARIES.

Thomas Aitken.—We put on record with regret the death of Mr. Thomas Aitken, the chairman of the London and Edinburgh Shipping Company, which took place on January 29th at his home in Kinross. Born about 80 years ago at Culross, deceased had been in failing health for more than a year due to a shock of paralysis. For more than half a century he was identified with the port and shipping of Leith. Trained as a shipbroker at Grangemouth, he joined the office staff of the London and Edinburgh Shipping Company in 1842, becoming general manager in 1854 when in his 45th year. When he first joined the company traffic was carried on by the well-known Leith smacks, but steam soon thereafter displaced sail, and just as the company had been famous for their clippers, so they soon established a splendid fleet of coasting steamers, plying not only between Leith and London, but to Lisbon, Cadiz, Oporto, Bordeaux and Charente, the fleet consisting of about a dozen steamers. Some of them, like the *Fiona*, built by the Caledon Shipbuilding Company, Dundee, two years ago, are of exceptional speed, and finely equipped for passengers. Besides ably controlling the London & Edinburgh Shipping Company, deceased was identified with many other industrial ventures as director. He was a prominent member of the Leith Dock Commission, the Edinburgh and Leith Chambers of Commerce, and the Edinburgh Merchant Company. He at one time held concurrently the chairmanship of the Fife Coal Company, the Revisionary Association of Edinburgh, the Galloway Steam Packet Company, the Scottish Cyanide Company, and the Linnrigg Coal Company, while also holding a seat on the Boards of the Irrawady Flotilla Company, the British and Burmese Steam Shipping, and various investment and insurance enterprises.

Ernest Gearing.—It is with feelings of the deepest regret that we carry out the painful duty of recording the death of a prominent figure in the engineering industry in the person of Mr. Ernest Gearing, of Leeds Forge. It has been our privilege to number Mr. Gearing among our friends for many years past, and our personal knowledge of him afforded ample evidence of the ground on which high esteem of him was based, not only in this country, but also in the United States of America and on the Continent. Mr. Gearing received his early training in the chief engineer's office of the Union Steamship Company at Southampton, and on leaving the South of England he took up the position of works manager of the shipyard of Messrs. James and George Thompson, Clyde Bank, Glasgow (now Messrs. John Brown and Company, Limited), and in this capacity he superintended the building of the steamships *City of Paris* and *City of New York*. Mr. Gearing went to the Leeds Forge in March, 1892, as engineer and commercial manager, at which time about 700 men were employed. The principal speciality of the company at that time was the manufacture of Fox's corrugated and Morison suspension boiler furnaces, the manufacture of pressed steel underframes and bogies for railway rolling stock being then in its infancy. In the year

1893. Mr. Gearing was appointed general manager and secretary, the late Mr. Samson Fox being managing director; in 1904, after the decease of Mr. Fox, he was given a seat on the Board of Directors, and in 1905 he became managing director of the company. During his connection with the Leeds Forge Company, the business has been gradually developed, until at the present time about 2,000 men are employed and the works are thoroughly equipped with the most modern machinery. The principal manufacture of the company at the present time is the well-known pressed steel parts for railway rolling stock upon the Fox system, including steel wagons of every description up to 50 tons capacity. Mr. Gearing was co-patentee of the suspension bulb furnace, which has recently been placed on the market by the Leeds Forge Co., Ltd., and which has been granted by the Board of Trade and other official surveys a higher formula than has been allowed to any other type of furnace. This furnace is now being rapidly adopted for marine purposes, and it is regrettable that Mr. Gearing should have passed away before he could see the full fruition of his efforts in this direction, on which we happen to know his heart was set. Mr. Gearing was exceedingly popular with all the employees at Leeds Forge, from the highest to the lowest. He had had considerable experience in marine engineering work, and was recognised as an authority upon naval engineering and matters connected with boiler construction. In recognition of his valuable services in various matters connected with the Admiralty, he was made Chief Engineer Officer of the Royal Naval Reserve. He was 57 years of age, and had hardly had a day's illness in his life. He travelled to London from Leeds on the 4th February, was taken ill suddenly on the 6th, and growing rapidly worse a specialist was called in and decided an operation for acute appendicitis was necessary, which was performed on the Wednesday night. The case was of such a serious nature that little hope existed as to the patient's recovery, and he passed away at noon on the 8th. He leaves a widow and three sons, one of whom is at present in South Africa.

Cochran & Co., Annan, Limited, have supplied Cochran Donkey Boilers to the s.s's *Anboti-Mendi* and *Amsteldam.*

S. T. Taylor & Sons, Scotswood, Newcastle-on-Tyne, have covered boilers, pipes, etc., of the s.s. *El Argentina* with "Tynos" non-conducting material, and boiler bottoms with their "Tynos" patent mattresses; H.M.S. *Cyclops* boilers with silicate cotton sheets, and iron pipes with silicate cotton strips, etc.; the s.s. *Billiter Buildings* covering boilers, pipes, etc., with their "Tynos" non-conducting material; the s.s. *Re d'Italia* covering boilers, pipes, etc., with their "Tynos" non-conducting material, and bottoms with their "Tynos" composition; the s.s.'s *Billiter Avenue, Euphorbia* and *Farley* covering boilers, pipes, etc., with their "Tynos" non-conducting material; and the s.s. *Guardiana* covering boiler bottoms with their "Tynos" patent removable asbestos mattresses.

BOARD OF TRADE EXAMINATIONS.

Ex 1C denotes Extra First Class.—January 26th, 1907.

Crispin, Owen J.	.. ..	Ex 1C Liverpool
Jones, Reginald M.	.. ..	Ex 1C Liverpool
Morgan, John H.	.. ..	Ex 1C Glasgow
Richardson, John F.	.. ..	Ex 1C Liverpool
Wallace, Lonsdale	.. ..	Ex 1C Liverpool

Note—1C denotes First Class; 2C Second Class.

January 26th, 1907.

Adam, Jas D .. 2C London	Berry, W. T. M. 1C Bristol
Adam, Robt. A. 1C Liverpool	Blacklock, B. L. 2C N.Shields
Adams, Wm. R. 2C Liverpool	Clouston, J. A. J. 2C N.Shields
Armitage, J. W. 1C Greenock	Cunningham, A. 1C Liverpool
Batty, Henry .. 1C Hull	DeAbaitua, M.H. 1C Liverpool
Baldock, T.H.S. 2C Liverpool	Donnan, Hugh . 2C Liverpool
Bennett, Gilbert 2C N.Shields	Ewing, R. R. .. 1C Liverpool
	Findlay, J. F... 1C N.Shields
Fimister, John . 1C Aberdeen	
Freeland, J. F. 2C Liverpool	
Gray, Arthur .. 2C N.Shields	
Gunn, Alex. .. 2C Greenock	
Hall, A. S. J. .. 2C Aberdeen	
Hayhurst, T. W 2C Sunderl'd	
Hartley, A. C. 1C N.Shields	
Hughan, J.M'G 1C Liverpool	
Hunnam, Geo. . 1C Sunderl'd	
Kingham, Chas. 2C Liverpool	
Macbean, D. A. 2C Aberdeen	
M'Conville, F. 1C Sunderl'd	
M'Kenzie, P. D 1C Liverpool	
M'Kenzie, Geo. 2C Liverpool	
Moller, C. R. R 2C Sunderl'd	
Morrison, A. D. 2C Liverpool	
Morrison, David 1C Sunderl'd	
Murray, G. W. 2C Greenock	
Neamonitos, J. . 1C Sunderl'd	
Nelson, Samuel 1C Liverpool	
Oakes, Geo. A. 2C Liverpool	
Osborne, Joseph 1C Sunderl'd	
Parsons, James 1C London	
Quested, W. J. . 2C London	
Ranson, Wm... 1C Sunderl'd	
Roberts, R. H. 2C Liverpool	
Rowland, F. C. 1C London	
Scanlon, Thos. 2C London	
Shepherd, Fred. 1C Bristol	
Speller, A. L... 1C Liverpool	
Stephen, John.. 2C Aberdeen	
Stokoe, C. L. .. 1C Sunderl'd	
Wallace, Wm.. 1C Greenock	
Ward, Edwd. J. 1C Hull	
Warren, Chas. 2C Sunderl'd	
Wayman, A. H. 1C London	
Whyte, Robert 1C Aberdeen	
Williams, Alfred 2C Bristol	

February 2nd.

Alder, J. D .... 2C Liverpool	Paterson, F. T. 1C South'ton
Allen, Chas. S. 1C Liverpool	Paterson, M'C.. 2C London
Brown, Wm. F. 1C N.Shields	Roberts, A. C. . 2C Liverpool
Browne, G. C. 2C Liverpool	Ross, John S... 2C Leith
Broom, J. M'C. 2C Glasgow	Russell, John .. 1C London
Buntin, James.. 2C Leith	Scott, Geo. N... 2C Glasgow
Burgess, Robert 1C Glasgow	Service, John A. 2C Glasgow
Butchart, James 2C N.Shields	Sibbald, John B. 1C Glasgow
Cockell, A. G. . 2C London	Stevenson, J. S. 2C Glasgow
Cornish, F. A . 1C Liverpool	Tait, Thos. M. . 1C N.Shields
Couper, Alex. .. 2C Glasgow	Thorn, Ed. R. . 2C Cardiff
Cust, Thomas.. 1C N.Shields	Tilley, Alf. C. . 2C Liverpool
Edwards, E. W 2C Liverpool	Vigg, Arthur H. 1C N.Shields
Ellery, James .. 1C Falmouth	Wakerley, E. J. 2C London
Evans, Wm. J. . 2C Cardiff	Wilson, William 2C Glasgow
Farmer, Wm. .. 2C Leith	
Farrell, F. H... 1C Liverpool	
Ferrier, T. D... 2C N.Shields	
Fleming, Alf. S. 1C N.Shields	
Fox, Chas. W. . 2C Cardiff	
Gallely, Wm. .. 1C Glasgow	
Ghest, Cecil S. . 2C Cardiff	
Gilchrist, D. .. 2C Glasgow	
Gordon, S. G. . 1C Leith	
Hackney, W. A. 2C Belfast	
Hankinson, T.W. 2C Liverpool	
Harper, W. R. 1C Liverpool	
Jenkins, G. E... 2C Cardiff	
King, Bishop N. 1C London	
King, Alexander 1C London	
Laidlaw, J. W. 2C Liverpool	
Learmouth, A.C. 2C Glasgow	
Malone, J. F. J. 1C Falmouth	
M'Cadames, R.W. 2C London	
M'Culloch, J. L. 2C Liverpool	
Melvin, John .. 2C Glasgow	
M'George, G. N. 2C N.Shields	
M'Gill, Donald 1C Glasgow	
M'Kenzie, M... 2C N.Shields	
Munro, J. B. .. 1C Liverpool	
Nicholson, T. .. 1C N.Shields	

February 9th.

Beanlands, Wm. 2C Liverpool	Keddie, John .. 2C N.Shields
Black, Michael 1C N.Shields	Linn, William . 2C Greenock
Butler, Thomas 1C London	Macdougall, A.H. 2C Dundee
Campbell, Geo. 1C Liverpool	M'Burnie, S. C. 2C Liverpool
Chiverton, Geo. 2C London	McLaughlin, J.P. 1C N.Shields
Elliott, William 2C London	Morrison, T. W. 1C Liverpool
Foulkes, R. E . 2C Liverpool	Nichols, Wm. J. 1C Liverpool
Gaitskell, J. W 2C Liverpool	Nicoll, Wm. O. 2C Dundee
Grey, Robt. B. 1C N Shields	Persich, F. J... 2C N.Shields
Jones, Edward . 2C Liverpool	Richardson, W. 2C Greenock
Luders, E. J.C.A 1C London	Roberts, S. L... 2C Liverpool
Milligan, R. S. 1C Liverpool	Sheppard, H. .. 1C Hull
Milligan, J. H. 2C Liverpool	Stuart, T. R. .. 1C London
Mitchell, J. W. 1C N Shields	Symonds, W. H. 1C Liverpool
O'Neill, Geo. A 2C London	Thompson, M.E. 2C Liverpool
Oxley, James T. 2C London	Tait, M. ..... 2C Dundee
Payne, Wm. H 1C Liverpool	Welburn, Frank 1C Greenock
Prime, Ed. A .. 2C London	
Ritchie, Ed. G. 1C London	
Robson, T. S... 2C N.Shields	
Sowerby, J. M 2C Liverpool	
Spicer, F. A. D 2C Liverpool	
Stephenson, W.F. 1C Liverpool	
Usher, Harry .. 2C Liverpool	
Waterworth, R . 1C Liverpool	
White, Sid. G. . 1C N.Shields	
Whyte, James.. 2C London	

February 16th.

Alexander, Wm. 2C Greenock	
Agerskow, E. G. 2C Hull	
Bennett, Ed. H. 1C Hull	
Bowles, Alf. H. 1C London	
Brokington, J.L. 2C London	
Bruce, Wm. A. 1C N.Shields	
Cowley, John .. 2C N.Shields	
Cruickshanks, J L. 2C Dundee	
Curry, R. L. .. 2C N.Shields	
Dawe, Wm. J... 2C N.Shields	
Dye, Charles .. 2C London	
Ellis, Thos. E. 1C Hull	
Fawcus, Walter . 1C London	
Grossomanidis, C. 2C Hull	
Grubb, Geo. H. 2C Hull	
Hay, John .... 2C Dundee	
Henderson, T.. 2C N Shields	

The Marine Engineer

And Naval Architect.

LONDON, APRIL 1, 1907.

THE discussions following upon the introduction of the Navy Estimates for 1907-8 were on the whole conceived in a spirit friendly to the present administration, although of course there were exceptions to the rule. The fact should not be surprising, because the shipbuilding programme has already been foreshadowed by Mr. Robertson, and it is not disputed that at the present time our supremacy afloat is assured, or that the arrangements for maintaining that state of things for some time to come are adequate. There is a saving which is perhaps more apparent than real, although the new construction for the year is to cost £8,100,000, as against £9,235,000 for 1906-7, the corresponding reduction on the Ordnance vote being £497,500. Of the sum asked for £7,340,618 is to be spent on the continuation of ships already begun, and £759,382 in beginning new vessels. The programme consists of two improved Dreadnoughts, and a third, "unless an understanding between the naval Powers be arrived at by the Hague Conference," one fast unarmoured cruiser, sometimes spoken of as a "mother-ship" for destroyers; five ocean-going destroyers; twelve first-class torpedo boats; and twelve submarines. The point in regard to this programme which seems most open to question is that which concerns the allocation of the vessels for building, because only the problematical battleship and a portion of the smaller vessels are to be built in the private yards. As the larger ships are not in any case to be laid down until the end of the year, it may be that this point will be further discussed on the shipbuilding vote, but we think it may be regarded as an axiom that unless the private shipbuilders are encouraged to undertake Government work, the advantage of quick construction upon which we largely rely for the maintenance of our position of supremacy will disappear. There is in the series of articles on "British and Foreign Warship Building Capability," which Sir William White supplied to *The Times* in November last, a pregnant paragraph which should not be overlooked in this connection. "Our great lead in shipbuilding has been obtained principally as a consequence of private enterprise, in association with remarkable developments of our mercantile marine during the last half-century. Government aid and encouragement have had an influence, no doubt, especially during the last twenty years, and in the growth of special manufactures such as armour, guns, and mountings. Can it be imagined that the national spirit will be changed so greatly that foreign developments would be allowed to deprive us of the advantageous position that has been achieved by long continued strenuous effort and great expenditure? British supremacy at sea requires the construction and maintenance of numerous and more powerful fleets. It has been, and must remain, a carnal feature in naval policy that our warship building capability shall be commensurate with all requirements and superior to that of other maritime nations. If foreign naval authorities, exercising their undoubted right, take steps to increase their powers of producing warships, corresponding action here will be essential, and the Government can depend, as they have done in the past, on the support of private enterprise."

The present position, so far as it concerns our superiority at sea, appears from Mr. Robertson's statement, which has not been seriously challenged, to be highly satisfactory. So far as the older vessels are concerned, that is to say, all the ships completed before the Dreadnought, it is clear that we have a superiority over any two powers and probably over any three. No European Power possess the equal of any one of our eight King Edward battleships, or our six cruisers of the Warrior type. Then as to later types, we have the Dreadnought completed; the Lord Nelson and the Agamemnon launched; the Bellerophon, Temeraire, and Superb, of the Dreadnought type, on the stocks; and three armoured cruisers, of the Invincible class building, of which one, the Indomitable, was launched on March 16. Against those vessels, neither France nor Germany had on March laid the keel of a single ship of corresponding force. In two years hence, that is to say in March, 1909, we shall have completed six battleships and three cruisers of the Dreadnought era, while neither France nor Germany will have a single vessel of that era ready. Or we may take eighteen months later, that is to say, the end of 1910, and we should have eight, or if three ships are laid down this year, nine battleships completed and afloat, as well as the three Invincibles, whereas France and Germany between them cannot have more than six battleships and two cruisers of similar types afloat. With these facts before us, it seems rather futile to quibble about the precise nature and meaning of the two-Power standard. The only other subject of importance that has been generally discussed concerns the exact state of effectiveness in which the newly constituted Home Fleet is to be maintained, and on this point we have the assurance of the Government that this force, which is to exercise in the North Sea, shall be as efficient as any other portion of the sea-going fleets.

THE Institution of Naval Architects has been receiving some interesting information as to safe submarine vessels and the future of the art, read by Mr. Simon Lake. It is a well-known fact that there has been nothing read before this Institution or others upon this question of submarine vessels, although these have been subjected to various mishaps in which a considerable amount of life has

been lost. Mr. Lake sets up the requirements that were given to inventors in 1893, but the Board being doubtful as to these being met, they finished the requirements by stating that there was no restriction as to the particulars given by inventors, and would not accept any responsibility as to the efficiency of the methods proposed. Mr. Lake has given an official list of no less than twenty-four accidents, seven of which have been attended with fatal results, 117 lives having been lost in these accidents. It is stated that had some of Mr. Lake's early experiences, and probably those of others early in the field been made public, it is not unlikely that a number of these fatal mishaps might have been avoided through the warnings of practical experience. It must be remembered that most of the inventors when carrying out their own experiments and the Admiralty do not give any reasons for the mishaps, so that others will not have the latest information to guide them.

After his first experience in the *Argonaut Jr.*, which ended up in his being held down under water by leakage into the water ballast compartment, his hand-pump then failed, and it was only by the release of a 600-lbs. drop-keel that gave the *Argonaut Jr.*, the necessary buoyancy. All submarine boats should have such a drop-keel so that it is available as a large release of dead weight, in case of some misfortune preventing the rising. The next boat in which Mr. Lake was engaged was still named the Argonaut, which was the first submarine fitted with internal combustion engines. With the gasolene carried inside; it was quite obvious from the smell that the journey would have been liable to a blow-up unless the tanks had been taken outside. In Mr. Lake's idea all submarine boats using gasolene should make this gas sure by fixing their storage tanks outside the boat. There was, however, one other trouble with this boat, the suction pipes from the engine took up outside air into the engine, but it was found during running that the suction pipes were delivering back a combusted charge as back explosions, thus poisoning the internal area. This trouble was avoided by fitting the induction tank with a check valve, so that if a back explosion took place it entered the induction tank, was held there by the check valve and was drawn away by the next stroke of the engine. The use of submarine wheels under the shell of such a vessel seem to be excellent matters; it either saves the vessel from coming too heavily down upon an under-strand, or as projections they seem to have saved this boat from running into rocks. Mr. Lake's later designs all show this fitting applied to the under shells of the boats. Mr. Lake evidently thinks the highest of the submarine boat, as in speaking of the future of the art he deprecates the finding of the Hague Tribunal that submarines are barbarous and unfair. He considers that when they exist they will prove the absolute protectors against vessels containing men. He states that recent experiments have proved that non-diving submerged boats have passed through narrow tortuous passages right up to the docks whilst look-outs were being maintained. He therefore considers the submarine boat has come to stay and that they will make the best ironclads ridiculous.

THE introduction of the turbine engine has made a considerable difference in the ordinary method of indicating engines, and it is as to the necessary means to indicate the torque of propeller shafting communicated to the institution of naval architects, by Mr. J. Hamilton Gibson, that deals with these modes of indicating from shafting. The shaft itself acts as a steel spring and it is pointed out that such a spring is different at different times and that such a spring should be re-calibrated periodically, when to be used for torsion meter records. It is to be remembered that there are two strains upon a shaft for transmitting power, there is the torsion and also a compressive strain due to thrust, which must not be neglected, as it amounts to 18% of that due to torque alone. Experiments have been carried out as to testing a shafting, the horse-power being expressed in direct terms of the angle of torsion, the diameter and the number of revolutions and inversely to a modulus of rigidity and the length of the shaft in inches. From this an effective horse-power may be worked out from any example of shafting. In describing now an excellent method of reading the torque of a revolving shaft, Mr. J. H. Gibson gives some details of his flash-light torsion meter, which consists of two thin discs which are secured to, and revolve with the shaft, and there is also a fixed lamp and a movable torque finder. The discs are similar, each being perforated near its periphery by a small radial slot. The lamp has a mask, also perforated with a similar slot, and the torque finder has an eyepiece which can be moved circumferentially and is also provided with a slot similar to the others. This paper closes with certain interesting arrangements for the torque on shafts in shops, and some views of flash-light torsion meters.

IN order that members of the Institution of Naval Architects should be kept as correct as possible in the formulæ that they are using, Mr. H. W. Johns has given a paper upon appropriate formulæ for determining the resistance of ships, in which he points out the errors as compared with practice of Middendorp's formulæ. The actual resistance of models are in many cases not more than half the results as obtained by this formula. This formula has been altered by a suitable book on Marine Engineering, but here the results are again very

different from model results. Admiral Fournier also has given a formula, but when applied to actual cases of modern vessels the results are greatly different from the results obtained from models. Mr. Johns, however, at last gives Mr. D. W. Taylor's formula which he considers gives the best result. It has been applied by Mr. Johns to over 30 different ships with marked results. A slight modification was observed by Mr. Johns, *viz.* in taking the length as the extreme length of immersed vessels, in place of that on the water line and in calculating the block co-efficient on the extreme length instead of that between perpendiculars, as is usually taken.

Mr. D. W. Taylor's expression is :

$$\text{Residuary resistance in lbs.,} = \frac{12.5\, b\ \text{D}\ \text{V}^4}{\text{L}^2}.$$

Where b is the block co-efficient, D is the displacement in tons, V is the speed in knots and L is the length on the water-line in feet. We are sure that the institution will be grateful to Mr. Johns for his making two of the recognised formulæ appear barren, with tests that he has made with definite samples, and also for him presenting a formula which can be relied upon for the results.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE spring meeting of the forty-eighth session of the Institution of Naval Architects was held in the Hall of the Society of Arts, John Street, Adelphi, on Wednesday, the 20th ult., and two following days. At the first day's meeting the chair was occupied by the President, the Earl of Glasgow, and among others who attended we noticed :—The Hon. C. A. Parsons, Sir William White, Sir James Williamson, Admiral Sir John Dalrymple Hay, Admiral Sir Gerald Noel, Mons. Bertin, Admiral Coerper (German Naval Attaché), Dr. Elgar, Professor J. H. Biles, Mr. E. A. Seaton, Mr. Sydney Barnaby, Mr. R. Humphries, Mr. D. J. Dunlop, Mr. J. L. Tweddell, Mr. R. Saxton White (Messrs. Armstrong, Whitworth & Co.), Mr. J. McKechnie (Messrs. Vickers, Sons, & Maxim), Mr. J. M. Dewar (Messrs. Cammell, Laird & Co.), Mr. John Ward (Messrs. Denny Brothers), Mr. James Gilchrist (Messrs. Barclay, Curle and Co.), Mr. May (Messrs. Wm. Beadmore), Mr. F. J. Trewent, Mr. C. E. Stromeyer, Mr. Edmund Sharer, Mr. James Hamilton, Mr. J. T. Milton, Mr. S. J. P. Thearle, Mr. Foster King and Mr. Stephen Terry.

The proceedings commenced at 12 o'clock, when, the President having taken the chair, the Secretary was called upon to read

The Annual Report of the Council.

This stated, *inter alia*, that the membership had increased, the roll now being 1,758 as compared with 1,711 in the previous year, the actual number of new members was 110; but against this there were 63 losses through death and resignations. The Honorary Treasurer's report showed an equally favourable financial state of affairs. The Council regret the deaths of several distinguished members of the Institution, and in accordance with the rules have elected Sir Wm. White and Mr. John Corry as Honorary Vice-Presidents. The first award of the Institution Scholarship was made last summer, the successful candidate being Mr. A. Cannon, of Devonport Dockyard. The four years' term of office of the representatives of the Institution upon the Technical Committee of Lloyd's Register having expired, the Council have re-elected Messrs. C. E. Allan, D. J. Dunlop and G. B. Hunter, together with Dr. J. Inglis (*vice* Mr. J. Dunn resigned), for the ensuing four years, and at the request of the Board of Trade the Council have elected Dr. F. Elgar, F.R.S., and Dr. J. Inglis, LL.D., to represent the shipbuilding interests upon the Advisory Committee to the Board of Trade. Having been invited by the President of the Association Technique Maritime to do so, it has been arranged to hold the summer meeting this year (June 25-28) jointly with that society in Bordeaux, where a Maritime Exhibition is to be held to celebrate the centenary of the application of steam to navigation. The gold medal of the Institution for 1906 was awarded to Professor R. L. Weighton, of the Armstrong College of Science, for his paper on the "Efficiency of Surface Condensers."

The Secretary having read the Council's report, the President announced that in accordance with the scrutineers' report the following gentlemen had been elected as office-bearers for the ensuing year :—As Vice-Presidents : Mr. Archibald Denny and Mr. J. D. Dunlop. As members of Council : Mr. James Bain, Mr. R. R. Bevis, Sir Benjamin Brown, Mr. P. T. Laird, Mr. H. R. Champness, Sir Theodore Doxford, Mr. James Gilchrist, Mr. James Hamilton, Mr. G. B. Hunter, Mr. W. J. Luke, Admiral H. J. Oram, Mr. A. E. Seaton, Mr. W. H. Whiting, and Mr. Henry Withy. As Associate Members of Council : Lord Armstrong, Hon. T. A. Brassey, Mr. C. E. Ellis, Admiral Fitzgerald, Captain Jellicoe, and Sir Thomas Sutherland.

The following gentlemen were also elected members of the Council : Engineer-Admiral Sir John Durston, Mr. J. S. Milton and Mr. W. E. Smith.

The list of candidates for membership having been read by the Secretary and the Chairman having nominated the scrutineers for next year, Lord Glasgow then proceeded to read his

Presidential Address.

Gentlemen, before commencing upon the few remarks with which it is customary for the President to open the proceedings at these annual gatherings of ours, I think I shall be only expressing the feelings of the members generally if I pay a passing tribute to the memory of one who had much to do with the creation and subsequent growth of this Institution, and who, since last we met in this hall, has been called away from his earthly labours. It was with Sir Edward Reed and a few others (including our esteemed Vice-president Sir Nathaniel Barnaby) that the idea of founding this Institution originated. He was the first to undertake its secretarial duties, and he subsequently filled, as you all know, the offices of Member of Council, Vice-president and Honorary Vice-president, successively. Throughout his long and varied professional career he never ceased to take the greatest interest in the success of the Institution, of which he was the most active organizer, and the pages of the Transactions bear eloquent testimony to his brilliant intellect and forensic talent. A staunch fighter and a generous opponent, he was ever ready to throw down the gauntlet in support of his views, and many a wordy battle has he waged in this hall, championing the theories that he so ably carried into practice in the designs for which he was responsible. His great intellectual powers enabled him to deal successfully with a wide range of subjects. In Naval Architecture he occupied a place second to none in his profession, his experience extending over every class of vessel from battleship to shallow-draught steamer; in politics, he was a noteworthy figure, and he sat for over twenty years in the House of Commons, representing for most of that period a constituency in which he was equally respected and beloved; while in literature he published works of travel and romance only second in value to those by which he has added so much to the status of Naval Architecture as a scientific branch of study. Indeed, it is largely owing to his early work in this direction that Naval Architecture now occupies the position it does among the scientific professions of the day. His place amongst us will not be easy to fill, but his memory will be kept alive by the recollection of our debt to his genius and zealous enthusiasm. In this connection, I may say that a movement is on foot for erecting to Sir Edward Reed a monument in his late constituency at Cardiff, and to which I wish every success. But his connection with this Institution might, I think, be suitably commemorated by the establishment of an annual lecture

on some subject connected with Naval Architecture which would be known as the "Sir Edward Reed Lecture." I commend the suggestion to the consideration of the Council, who, if they think fit, could doubtless arrange to carry it into practical effect by our next annual meetings.

Turning now to a brief retrospect of the salient events of interest during the past year, it must be allowed that, although the close of hostilities in the Far East brought a much-desired period of peace, yet there have not been lacking other factors tending to unsettle the general resumption of trade activity. Notwithstanding this, however, it is doubtful whether we have ever enjoyed a period of greater general prosperity, as shown not only by the various trade returns for the United Kingdom, but by the many indirect evidences of well-being.

I do not propose to tread upon the delicate ground of fiscal controversy, nor even, confining myself to the shipbuilding results of the past year, shall I weary you with figures which, however interesting they might be as indications of the trend of this great industry, would form a somewhat dull prelude to the more attractive matter that awaits you in the shape of papers. Suffice it to say that the past year has once again witnessed a record in the shipbuilding output of this country, the 1,828,000 tons of mercantile ships launched being 200,000 tons in excess of the year before, which in turn was largely in excess of any previous year's total. The result is remarkable, in view of the fact that the strike upon the Clyde, which occurred during the latter part of 1906, paralysed the shipbuilding industry in that district during a period of seven weeks. Notwithstanding this interference, the Clyde yards again head the list in the output of tonnage, although, if classed by towns, Newcastle-on-Tyne has, like last year, a substantial lead over her rival Glasgow, and the output of the latter is but slightly in excess of that from the Sunderland yards. All three districts show excellent results for the past year's work, and nearly all the yards throughout the kingdom have contributed to swell the total returns of this great industry. Indeed, it is remarkable to see how rapidly the world's carrying trade is able to assimilate the vast amount of tonnage that is launched each year from the various yards that contribute to this end. But it is not surprising to learn that, labour and materials having risen in cost during this time, there is now a disposition on the part of shipowners to await a return to more favourable prices before placing fresh orders.

The returns from abroad also are indicative of similar activity during the year under review. With the exception of France and Italy, there has been a notable increase in the volume of shipbuilding, more especially in the United States, where the very large number of ships launched accounts for the bulk of the increase in the output of foreign tonnage for the past year. Germany also continues to build an increasing amount year by year, notwithstanding the fact that a large number of British-built ships are ordered for German owners.

Moreover, the relative increase in the size of individual vessels appears to keep pace with the increase in the number of ships built. The launch of the *Lusitania* and *Mauretania*, the two 32,500 ton vessels built for the Cunard Company, on the Clyde and Tyne respectively, marks another epoch in the history of naval architecture. Notwithstanding her merits as a remarkable example of the shipbuilder's art, the commercial failure of the *Great Eastern* had led many to believe that such a large ship would not again be laid down. Yet the past year has seen the successful launch of two ships materially larger in every dimension than their earlier prototype, and everything points to their fulfilling the high hopes that are entertained of their successful performance when they take their station on the great Atlantic thoroughfare.

In my address last year, I was able to congratulate the members of the Institution on the fact that marine engines developing nearly one million and a half horse-power had been constructed in the United Kingdom during the preceding year. I have now to chronicle a very substantial advance on even that figure, machinery capable of indicating over 1,800,000 H.P. having been constructed during 1906. Judging by present conditions, it can hardly be hoped that this exceptional activity in engine construction will be maintained. The continued and extended use of the turbine engine for marine propulsion is again a feature of the returns for the past year. Its efficiency for steamers such as are required for cross-Channel service was already demonstrated; it only remained to prove its reliability and economy for Transatlantic work, and this is now being sought in the examples already in service in the Cunard, Allan, and other lines, and will be put to further test in the two great vessels to which I have already alluded. These two turbine-propelled ships account for no less than 140,000 H.P. They will certainly not be repeated during the coming year, but it may be that their successful performance will lead to the substitution of turbine machinery for reciprocating engines. This would give a stimulus to the engineering trade similar to that experienced when the three-stage compound engine took the place of the original type—a prospect at which engineers rather than shipowners are likely to rejoice.

The output of machinery for war vessels during 1906 equalled 217,200 H.P., and of this nearly 70,000 H.P. was for vessels built for foreign Powers. Although the total given is less than for many years past, it is somewhat surprising to see that the horse-power of warship engines for foreign countries was considerably higher than it has been for some time past, and this is the more satisfactory, as the previous year, which accounted for 48,100 H.P. was the next highest of the past six years. Making all allowance for the wide fluctuations that must occur in the production of marine engines, as in ship-building tonnage, owing to the possibility of several large vessels being launched at the beginning or extreme end of one year (thus, as it were, robbing adjacent years), the figures are satisfactory; all the more so, as they could hardly have been expected. With the determination of other Powers to be self-supporting in regard to war material, more especially in regard to ships, one might reasonably have anticipated that the demand in this country would have fallen off rather than increased. Let us hope that there will be a continuance of this branch of industry, for we must remember that it is not only a source of commercial profit to construct war vessels for foreign Powers, but it also adds to our shipbuilding resources and thus indirectly to the naval strength of the country.

The feature of the year in marine engineering was undoubtedly the successful completion of the *Dreadnought*, whose trials last October set the seal upon a piece of work that is remarkable in every way. The results, as stated by the First Lord of the Admiralty, have given "the highest satisfaction," and on her subsequent passage from Gibraltar to Trinidad, a distance of 3,400 miles, she maintained an average speed of over 17 knots. Although the economy of the turbine at lower powers is still unsatisfactory as compared with the reciprocating engine, the trials of the *Dreadnought* have confirmed the belief in the economy of this form of engine when working at full power—the fuel consumption, as reported unofficially, having worked out at 1·51 lbs. of coal per shaft H.P. per hour. It is, however, not easy to make a comparison between the efficiency of reciprocating engines, the power of which is measured by the indicator, and that of turbine engines, whose power is taken on the shafting. The details of this method will, I expect, be elucidated by the two papers on this subject, one of which is from the pen of our friend Mr. Archibald Denny, whom all are delighted to find again contributing to the Transactions. By the ingenious idea of enlisting into his service the torsional effect on the shafting, the originator of this new power-recording instrument has been enabled to reach a result which so great an inventor as the late Mr. Froude strove for many years to accomplish with but partial success in the registering of large powers.

Next to the steam turbine, the internal combustion engine is the most interesting feature at present in the field of marine engineering. Although no very remarkable developments have taken place since I last addressed you from this chair, the use of this type of engine for marine work in small craft of various kinds has continued to make good progress. Its popularity for pleasure boats and launches continues to spread, while for commercial purposes engines using heavy oils and running with great economy and regularity are now being turned out by a number of firms. In our submarines the petrol engine continues to be used for surface propulsion, and one of last year's additions to our fleet of torpedo boats was an experimental one, 60 ft. long, built by Mr. Yarrow's firm at Poplar, and propelled by three sets of internal combustion engines, each driving its own screw. The speed of this boat was 25½ knots, which was 5½ knots

faster than that which would have been reached had steam machinery been installed.

It is not, however, to petrol engines that we can look for the propelling machinery of vessels of any considerable tonnage, the costly nature of the fuel puts it out of the question; and, so far as we can see at present, ordinary paraffin stands only second in this category. The application of the suction gas producer to marine practice, however, affords hope of using our cheapest fuel, coal, without the intervention of the steam boiler. The elucidation of this problem is beset with difficulties, but many able minds are at work upon it; and after the start that has been made with the experimental boats, of which we heard some account last year, we may reasonably hope for further interesting developments in this field of enterprise at no distant date. Already we hear rumours of a suction producer and gas engine of power sufficient to propel a sea-going vessel of large size; and the paper you will shortly hear will, I hope, give rise to some additional information on this topic.

The trials and subsequent cruise of the *Dreadnought*, to which I have already alluded, have, I think, justified the Board of Admiralty in their selection of a design embodying, not only the lessons taught by the war in the Far East, but also the successive improvements in type of a long line of warships, due to the skill of our ablest constructors. The result must be equally gratifying to those upon whose calculations and estimates the designs were based, as well as to those to whose care and skill was entrusted the execution of the work. But, although we have led the way in this phase of naval development, we cannot afford to rest upon our laurels while other nations hasten to make up for lost time.

Unfortunately, our imperfect political machinery tends to create a discontinuity of policy that seriously affects the shipbuilding programmes of the Navy. A glance at the Naval notes of successive administrations shows them to be subject to some mysterious periodic law. The mistaken parsimony of one Government is followed by the lavish outlay of the next. The swing of the political pendulum carries us alternately towards the opposite poles of financial administration. Such fluctuations cannot make for the highest efficiency. The worker's employment and wages are affected by the ebb and flow of a tide whose movements he cannot foretell with any certainty; the taxpayer's burden is aggravated by sudden calls upon his pocket for the maintenance of the Naval and Military forces; while the security of the country is jeopardised every few years by allowing the defences to fall below what experience has shown to be the minimum strength requisite to cope with any probable combination of Powers likely to be arrayed against us.

This year's Estimates are remarkable for the spirit of economy which they display. A saving of £1,427,000 is shown over last year's estimates, which in turn were £1,520,000 less than the preceding year. The proposed outlay on new construction is £8,100,000, compared with £9,235,000 last year. The number of battleships to be laid down is three, one of which, it is stated, is not to be built if the forthcoming Conference at the Hague should bring about an agreement for the reduction of armaments among the great Powers. However devoutly we may wish for such a consummation, I fear that the chances of this warship not being required are somewhat slender! The battleships are to be of an improved *Dreadnought* type, heavier and more powerfully armed, and their design is to embody the experience gained by the trials of the first ship of this class. Of cruisers, only one is proposed to be laid down, and that one is to be designed with a view to acting as a parent ship to destroyers. Five ocean-going destroyers, twelve first-class torpedo boats, and twelve submarines complete what, it must be admitted, forms the very modest programme recently laid before Parliament. Now, economy with efficiency, everyone will agree, is an excellent principle for a Government to follow, and every taxpayer will rejoice at the prospect of seeing his burdens lightened; but the business of the Naval administration is to see that the strength of the fleet in ships, in men, in equipment, and in auxiliaries is kept up to the high standard that has rightly been fixed by successive administrations. This cannot be done without money any more than bricks can be made without straw—in Egypt, at any rate—and it remains to be seen whether the present estimates will prove adequate to our legitimate requirements.

The item of repairs is one which is only second in importance to that of new construction, and it is satisfactory to have Lord Tweedmouth's assurance that, gauged by the number of ships now available for service as compared with the corresponding state of things three years ago, the present time shows a remarkable improvement. At the same time rumours are still current of a congestion of ships awaiting repair at our principal dockyards, and it is certainly to be hoped that this class of work will, without delay, be dealt with systematically and effectually.

An occurrence for which the present estimates do not appear to make special allowance is the loss of H.M.S. *Montagu* off Lundy Island last July. The accident and subsequent salvage operations were fortunately unattended by loss of life, dangerous as these operations necessarily are. Everything that was humanly possible was done to refloat the stranded battleship; and, had the weather been more propitious at the times when supreme efforts were made to float her, it is probable that these would have been crowned with success. As it is, however, a valuable modern battleship has been lost to the fleet, and the number now contemplated to be laid down seems hardly sufficient to maintain what was only recently adopted as the official minimum of the annual addition to our battleship strength.

The loss of the *Montagu* illustrates very forcibly the perils to which warships as well as merchant craft are exposed, even in times of peace. The continual recurrence of fogs around our coasts makes it particularly desirable, in view of the large interests at stake, that steps should be taken where practicable to minimise these risks. You will remember that two years ago a paper was read before us on the subject of signalling by means of submerged bells, the sound being caught by receivers attached to the interior of a ship's hull, the port and starboard receivers enabling the sounds to be located approximately. Whether the loss of the *Montagu* would have been avoided had such an apparatus been fitted in her, and a submarine bell installed on Lundy Island, no one can say for certain, but it is satisfactory to hear that since that untoward event the Admiralty authorities have made exhaustive tests of this means of intercommunication between ship and ship or shore, and the report upon the results obtained appears to establish the reliability of the system under the most trying conditions of wind and weather, and strongly emphasises the need of such safeguards being fitted at the various danger-spots that surround our coasts. It is to be hoped that recommendations emanating from such an authoritative source may be carried into effect without delay, and be the cause of reducing one of the greatest risks connected with the navigation of the seas.

Of the dangers to which warships are at all times exposed our friends across the Channel have just had, alas! only too sad a proof. The terrible calamity that befel the French battleship *Jena* in Toulon Harbour last week has evoked feelings of the deepest sympathy throughout this country. The heroism displayed by the survivors has touched a chord in our own hearts—the "one touch of nature that makes the whole world kin." We offer our heart-felt sympathy to the grief-stricken relatives of those who have suffered losses by this calamity; and our unfeigned admiration of brave deeds performed by those who imperilled their lives in assisting to extricate the victims from the burning ship.

On the conclusion of his address the President handed the gold medal to Professor Weighton, and heartily congratulated him upon his success in winning it.

Mr. McKechnie was then called upon to read his paper upon "The influence of machinery on the gun power of the modern warship."

The paper, which was chiefly interesting to the gunnery officers, led to a lengthy discussion, in which Admirals Fitz-Gerald, Noel and Fremantle, as well as Sir William White, Lieutenant Dawson and Mr. James Hamilton took part, the adjournment for lunch being made during the discussion.

Mr. McKechnie having been cordially thanked, the President called upon Mr. Simon Lake to read his paper on "Safe Submarines and the Future of the Art." As this paper is dealt with in our editorial columns we need here only recount in brief the discussion that followed upon it.

This was opened by Lieut. Dawson, who thanked the author for his excellent paper, and regretted that it was impossible for him to enter into details regarding the working

of our submarines, as under the regulations he was debarred from doing so. He attached great importance to keeping these official secrets, and fully agreed with the author of the paper that the submarine boat of to-day is really a valuable naval weapon. Captain Lees dealt with the accidents referred to in the paper, and did not agree with the author's advocacy of drop keels, and instanced that in the case of the *Lutine* only one of the four drop weights acted. In the case of our "A 8" it was shown that the men died through chlorine poisoning, due to the evolution of chlorine gas when the salt water came into contact with the powerful electrical terminals. Mr. Stephen Terry and Captain Hall having spoken, Mr. Lake replied, and was accorded a hearty vote of thanks for his paper.

ON SOME POINTS OF INTEREST IN CONNECTION WITH THE DESIGN, BUILDING, AND LAUNCHING OF THE "LUSITANIA."*

By W. J. Luke, Esq., Member.

In offering this brief record to the Institution of Naval Architects for inclusion in its Transactions, it will probably be quite unnecessary to preface it with any reference to the past history of transatlantic traffic. Neither will it be necessary to review the reasons leading up to the decision to build the two vessels now being constructed for the Cunard Steamship Company.

When this decision was made the number of large fast transatlantic liners was 17, and the principal particulars of the five fastest are set out in the following table :—

	Campania.	*Kaiser Wilhelm der Grosse.*	*Deutschland.*	*Kron Prinz Wilhelm.*	*Kaiser Wilhelm der Zweite.*
	ft. in.	ft. in.	ft.	ft.	ft. in.
Length over all	622 0	648 6	684	663	706 6
Length B.P. ..	600 0	625	663	—	678 0
Breadth	65 3	66	67	66	72 0
Moulded depth	41 6	43	44	43	44 2
Ordinarydraught	25 0	28	29	29	29 6
Displacement, tons	18,000	20,880	23,620	21,300	26,500
Reputed speed, knots.....	22	22·8	23·5	23·5	23·5
I.H.P.	30,000	32,000	36,000	36,000	39,000
Grate surface, sq. ft.	2,630	2,618	2,188	2,702	3,121
Heating surface, sq. ft.	82,000	84,285	85,468	93,865	107,643
Type of draught }	Open Stoke-hold.	Open Stoke-hold.	Howden's Forced	Open Stoke-hold.	Open Stoke-hold.

The above particulars have been taken from the columns of the technical press. Before passing from this point, it will be well to remark that the writer disclaims any responsibility for the figures, except that of careful copying ; and as an illustration of the distrust with which some of them should be received, it may be as well to point out that the result apparently produced in one case, *viz.*, 13·3 I.H.P. per square foot of grate with natural draught is altogether untrustworthy. This, then, represented the public stock of information when proposals for the construction of two new vessels were invited by the Cunard Company.

It need occasion no surprise when it is stated that the conditions which it was demanded should be fulfilled, were somewhat in advance of what was eventually found to be reasonably practicable ; in the end, after the Cunard Company had instituted a committee of inquiry into the question of turbine propulsion, and after prolonged and valuable assistance from the Admiralty officials through the testing of models in the Haslar Experimental Tank, it was decided that the dimensions and principal particulars were to be as follows :—

Length over all	787 ft.
Length B.P.	760 ft.
Breadth moulded	87 ft. 6 in.
Depth moulded to shelter deck amidships	60 ft. 4½ in.
Displacement at 32 ft. 6 in.	36,440 tons.

The contract for the *Lusitania* was placed with Messrs. John Brown & Co., Ltd., of Sheffield and Clydebank, who are builders of both hull and machinery, and the contract for the sister vessel, the *Mauretania*, was placed with Messrs. Swan, Hunter & Wigham Richardson, Ltd., of Wallsend-on-Tyne, with machinery in this case by the Wallsend Slipway Company. The subsequent particulars have exclusive reference to the former vessel, though it will of course be at once apparent that for sister ships building for the same owners, at the same time, very many of the particulars and details are common to the two cases.

The building berths at Clydebank are situated on the northern side of the Clyde, opposite to the mouth of the small tributary the Cart. The expanse of water into which launching takes place is, however, not unrestricted, and for this reason, as well as taking the present slope of the berth into consideration, it was decided to lay the keel at a slope of $\frac{7}{16}$ in. per foot, and to arrange for a launch at a mean slope of $\frac{5}{100}$ in. per foot. These figures enabled the vessel to be placed at a satisfactory height from the ground, while excessive height of blocks at any place was avoided ; and with the probability of a launch in moderately warm weather it gave enough slope to the ways to promise a successful launch without undue chance of exposing the vessel to risk in the restricted available waterway. Careful attention was given to piling the ground at the places where heavy pressure would necessarily come upon it in the launching operation. On other parts of the berth, no special precautions were required, as the ground was well consolidated, and the size of ship in relation to the estimated weight of material worked in before launching made it sufficiently evident that the vessel would not be (in this sense) heavy. For this reason, too, the keel blocks were spaced and constructed in normal fashion.

Before noting any of the details of construction, it should be stated that in consultation with Lloyds' Surveyors (the vessel being classed with Lloyds'), it was decided that, on the basis of mild steel construction, the materials of the hull should not be subjected to a stress exceeding 10 tons per square inch ; the calculations in this connection followed the usual conditions accepted in previous cases, namely, that consideration should be given to the possibility of the vessel meeting with waves of her own length, and whose height from trough to crest would be one-twentieth of the wave length ; in the calculation for inertia of section such parts were to be included (or omitted) as had previously been customary. I am well aware that a strong case could be urged against both these points ; but it is unnecessary to raise any argument on this occasion, as there is no desire to bring up controversial points. It was also decided to leave out of account in the calculation the "Smith Correction," so that in view of these points, as also of the fact that no attempt was made to make any estimate of the stresses due to pitching and 'scending or of heaving, the stress of 10 tons previously mentioned must be read to be purely comparative in amount.

The preliminaries having been thus adjusted, calculations were proceeded with, the results making it apparent that the maximum bending moment (of slightly over one million foot tons) occurred in the condition when nearing port with bunkers almost empty. The stress is one of hogging, the corresponding sagging stress being only about half this amount.

It may be remarked that the corresponding bending moments in a load condition assumed at a displacement of about 20 per cent. in excess of the arrival displacement, are slightly less for hogging, and for sagging—not very different from the case previously considered.

The structural details in so far as they are usually determined on the midship section were, in consequence, got out for mild steel on the basis of the above-mentioned calculations. In view of the fact that the severest stresses were such as

* Read at the Spring Meetings of the Forty-eighth Session of the Institution of Naval Architects, March 21st, 1907.

put the upper works in tension, it was determined to adopt high tensile steel of reduced scantling in these parts, provided such material could be produced of satisfactory quality. The investigation into this matter occupied some time, but fortunately, owing to the position in which it was intended to use the new material, no hindrance to the progress of work resulted from this investigation. In the end, it was demonstrated that a satisfactory material could be produced whose average ultimate tensile strength was at least 20 per cent. greater than the average for the usual quality of mild steel, and in consequence a reduction in certain scantlings of 10 per cent. from the scantlings fixed for mild steel was adopted. This reduction not only caused considerable saving in weight, but made for better riveting, owing to the thinner plates and smaller rivets used.

It has also the effect of lowering the neutral axis of the transverse section, and increasing the stress on the material beyond the accepted limit for mild steel, but this increase of stress comes entirely on high tensile steel, and is very moderate in amount. Full details of the calculation for the moment of inertia of the section are given subsequently; the midship section is illustrated in Fig. 1 and the list of scantlings is appended

It will be noted that five continuous longitudinal girders are adopted, *viz.*, the centre keelson, the margin plates, and the fifth girder on each side. The water-tight division of the ballast tanks is made by the centre keelson and the margin plates, only (in association, of course, with water-tight floor plates), no attempt being made to make water-tight the intermediate continuous longitudinals.

The floor plates are spaced at 32 in. centres for a length of about 300 ft. amidships; at the ends the spacing is 26 in. forward and 25 in. aft, the closing in being gradually performed. They are 60 in. deep amidships, and have a maximum width at the margin plate of 48 in., this latter point being to some extent governed by the joint effect of the convenient depth of bottom worked to in association with the adoption of a level margin at the height chosen. In association with the continuous longitudinal keelsons previously noted, it will thus be seen that the floor plates are in one length from the middle line to the fifth keelson, and from thence to the margin they are also in one piece, this arrangement leading to convenient floor plates below, and to the avoidance of inconvenience at the turn of the bilge. They are generally $\frac{10}{20}$ in. thick, except under the boiler stools, in which case (following a common precedent) they have been made $\frac{2}{20}$ in. thicker. It may incidentally be mentioned that, owing to the great depth and the comparative closeness of the frames, the lightening holes in the longitudinals are arranged with their larger dimension placed vertically, and one has therefore the rather curious experience of being able to *walk* with comfort through each frame space of the ballast tanks. The frame and reverse-bars up to the margin plate are joggled to avoid the necessity for slip iron.

The flat plate keel is in three thicknesses, arranged as shown in Fig. 3. It will be seen from this sketch that the connections of the parts forming the centre girder are arranged in the usual manner, the only points which are unusual being the connection of the garboard plates to the flat keel plates, and the fact (as mentioned on the sketch) that the longitudinal connecting angles have no butt straps. All the plates in this combination are at least 32 ft. long; they have well shifted butts, and the whole of the riveting is performed by hydraulic power. Having regard to the great necessity of securing fair holes, only the inner thickness of keel was punched and the plates being assembled correctly, the holes through the remaining thicknesses were drilled in place. The plates were then separated, and drillings, etc., removed from the faying surfaces, the edges of the holes were slightly reamed, and the whole re-assembled for riveting. The connecting bars for

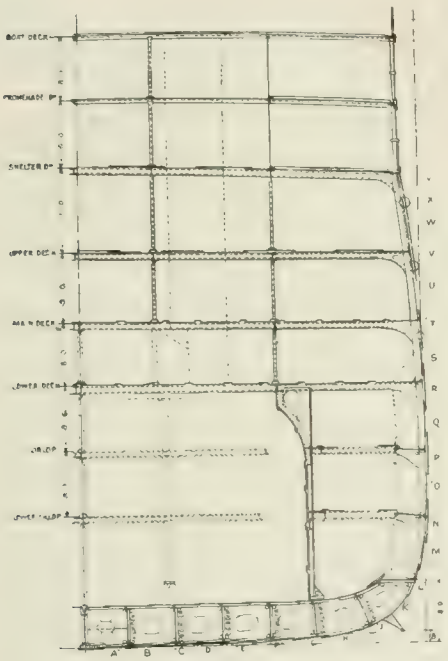
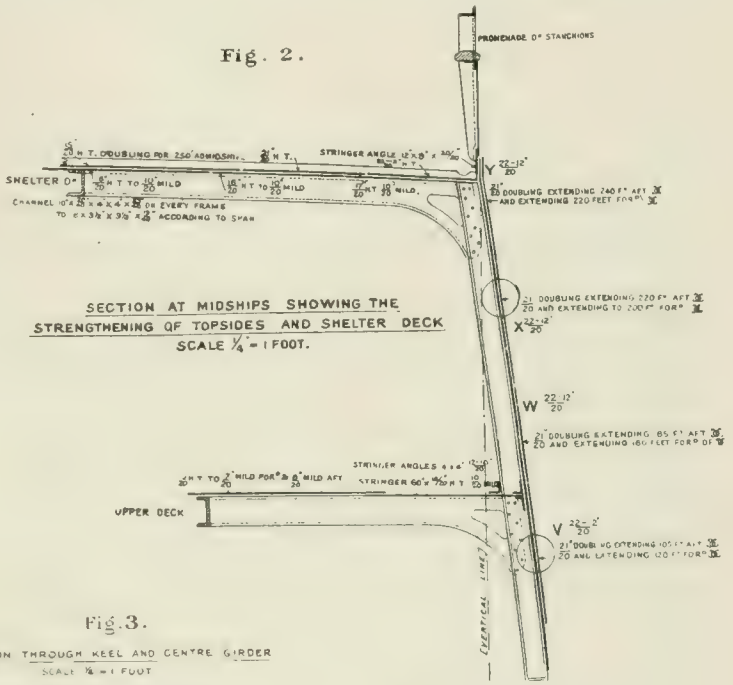


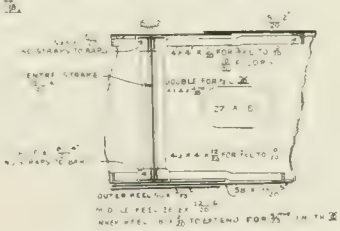
Fig 1.
O.S.S. "LUSITANIA" MIDSHIP SECTION
SCALE 1/16 = 1 FOOT

Fig. 2.


PROMENADE D^K STANCHIONS
SHELTER D^K
STRINGER ANGLE
DOUBLING EXTENDING 240 FT AFT AND EXTENDING 220 FEET FOR D^K
DOUBLING EXTENDING 220 FT AFT AND EXTENDING TO 200 FT FOR D^K
DOUBLING EXTENDING 85 FT AFT AND EXTENDING 180 FEET FOR D^K OF W
DOUBLING EXTENDING 105 FT AFT AND EXTENDING 100 FT FOR D^K
STRINGER ANGLES
STRINGER 60" × 25/32 M.T.
UPPER DECK
CENTRE LINE

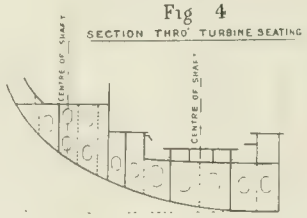
SECTION AT MIDSHIPS SHOWING THE STRENGTHENING OF TOPSIDES AND SHELTER DECK
SCALE 1/4 = 1 FOOT.

Fig. 3.



SECTION THROUGH KEEL AND CENTRE GIRDER
SCALE 1/2 = 1 FOOT

Fig 4



SECTION THRO' TURBINE SEATING

the centre keelson were riveted first and before the garboards were put in place; experience in the *Caronia* and *Carmania* (where a somewhat similar keel construction has been adopted) showed that the closing power of the hydraulic riveter was such that it was necessary to get the garboards in place before any other riveting on the flat keel was proceeded with, and this course had to be followed. The garboards were therefore got into place at a very early stage of the work, and before any transverse frames were erected; the riveting machines were naturally of very large gap, and the necessity for keeping them within practical limits has led to the adoption of a width of plates in this connection, which (but for this explanation) might be considered rather low. It will be noted in passing that this combination of keel plates avoids the necessity of butt straps, which fact was considered of some importance—at least as regards the straps on the outside.

The next point which deserves notice is the shell plating on the lower part of the bottom. This plating is worked clinker fashion, the frame bars being joggled, as before stated, to avoid the use of tapered slips, and the plates are lapped in the way shown for convenience in riveting. A large portion of the shell riveting, in fact nearly all of it to the turn of the bilge, has been done by hydraulic power, and as the closeness of the frames and floors made it quite impracticable to use machines of large gap, no course was open but to lap the plates as shown. Each strake could in this way be riveted right up to the edge seam connecting to the next strake to be brought on. In this lower portion of the bottom, the edge seams are double riveted, and the butts have double straps, the outer being double, and the inner treble riveted, with openly spaced rivets in the third row. The edges of the outer straps are slightly chamfered.

From a little above the turn of the bilge the plate edges are sheered in lines approximating to the sheer of the ship, and the strakes below are worked as stealers into the edge of the lowest of the parallel strakes, thus avoiding an excessive number of narrow strakes at the bow and stern. A little care was necessary in carrying out this disposition to arrange that each bilge keel could be worked entirely on one strake, and in this way long and awkward crossing of lines of rivets in plate edges was avoided.

In the wake of the engine-rooms the framing is considerably deeper than in the remaining portion of the bottom, and additional fore-and-aft girders are introduced in order to provide beds of suitable height and stiffness for the propelling machinery. A typical section (in outline) is shown in Fig. 4; it is obvious that the arrangement is only applicable to this case, and would require to be varied according to the number, width, and height of the shafts, the size of the machinery and the method of supporting it.

The whole of the riveting in the double bottom for connecting the transverse and fore-and-aft framing is performed by hydraulic power. The inner bottom plating calls for no special remark; the riveting is necessarily performed by hand.

The frames above the margin are formed of channels 10 in. by $\frac{30}{40}$ in. by 4 in. by 4 in. by $\frac{23}{40}$ in. for $\frac{3}{5}$ L *X* to 9 in. by $\frac{20}{40}$ in. by 4 in. by 4 in. by $\frac{23}{40}$ in. secured by heavy brackets to the margin plate and fortified by web frames averaging four frame spaces apart. These channel frames are continuous from the margin plate to the shelter deck and call for no further notice.

The shell plating above the turn of the bilge is, as before stated, arranged in strakes approximating to parallelism with the sheer line worked with lapped edges and with lapped butts where in one thickness. The plates are generally about 33 ft. long, that is, 12 frame spaces, plus the lap of the butt; the edges are treble riveted and the butts quadruple riveted. A considerable portion of this plating is of high tensile steel, as is shown in Fig. 5, the lightly hatched parts being of one thickness only, and of the same scantling as would have been adopted for mild steel, the more heavily hatched portion being in two thicknesses and of reduced scantling, in consideration of the strength of the material. Throughout the region of doubled thickness, hydraulic riveting was adopted. The edges are treble riveted, and the butts of the doubled portion are strapped outside and inside at butts of the outside plates, the outer straps taking three rows of rivets, and the inner straps taking four rows; the thicknesses of the straps are reduced on account of the doubling. The butts of the inside plates are strapped on the inside and quadruple riveted.

All the holes in the high tensile steel were drilled, and more than usual care was adopted to clean off all drillings, etc., from the faying surfaces, and to ream the edges of drilled holes. As it was not convenient to remove the plates far from their location on the side to perform this operation, a special hand tool was devised, which, with a few smart turns, reamed at once both edges of the hole under treatment, and was found to give every satisfaction in its use.

Very great care was taken in arranging the butts and edges of this work, in relation to the sidelights, etc., coming through this thick plating, and in addition a very uniform system of tack riveting was adopted for the purpose, as far as possible, of getting the plating of this member of the strength girder united over its whole extent as uniformly as practicable.

The beams are of the scantlings noted in the Appendix, and have forged knees for the sake of lightness.

The deck plating is also shown on the section. A considerable portion on the shelter deck, and a less extent of that on the upper deck is of high tensile steel (Fig. 2), and the whole of the doubled portion on the shelter deck and the stringer on the main deck in wake of the doubled high tensile plating on the side is hydraulic riveted. The remaining deck plating is principally of such a nature as is necessary to provide suitable floorings, and occupies only a secondary place as regards the structural strength of the vessel. The large openings in the decks, *viz.*, funnels and ventilators, are arranged, as far as practicable, in the same fore and aft lines, so that important strakes of plating are run through for long uninterrupted lengths, and these openings have heavy doublings and well-rounded corners.

The main bulkheads are formed of high tensile steel, $\frac{10}{20}$ in. thick in the lower parts, and $\frac{8}{20}$ in. thick up to the main deck. Above this they are $\frac{6}{20}$ in. thick, also of high tensile steel. There are eleven main transverse bulkheads, and the subdivision is carried considerably further by the longitudinal bunker bulkheads, by the two bulkheads in the engine-room, and by the partial bulkheads in the coal bunkers. The midship section shows how the longitudinal bulkheads are stiffened and braced to the side. These engine-room bulkheads, being connected to the longitudinal bunker bulkheads, and of strong construction, form valuable girders contributing to the strength of the ship, and, as they are well stiffened and braced, they are kept up to their work. The main transverse bulkheads have vertical channel stiffeners on one side 12 in. by $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{11}{20}$ in. to lower deck and flanged stiffeners above, and on the same side horizontal girders 32 in. broad with a face channel 9 in. by $\frac{10}{20}$ in. by 4 in. by 4 in. by $\frac{23}{40}$.

The stem is of cast steel, and is rabbeted to receive the shell plating. The sternpost is a steel casting suitably shaped for supporting a large balanced rudder such as is fitted. The rudder is composed of three steel castings, and the rudder head is of forged steel; all the parts are connected by horizontal flanges, well rabbeted and heavily bolted. The rudder area is 300 sq. ft.; there is one removable pintle, and the steering gear (in duplicate) is below the normal waterline. The spectacle eyes are of cast steel, the two after being riveted to the stern post, and those for the outer shafts being well incorporated with the framework of the hull at positions about 90 ft. before the after perpendicular. It may be of interest to note that the weights of these items are as follows:—

	Tons.
Stem	8·37
Sternpost	59·43
Rudder	56·43
Four spectacle eyes	60·24
Total	184·47

The reasons leading to the desire to use high tensile steel have already been mentioned, and a few details of the mean results of the experiments undertaken to ascertain the relative merits of the different materials are given here by the favour of Messrs. David Colville & Sons, Ltd., of Motherwell. It is quite apparent that, although the ordinary mechanical tests can be readily enough carried through in the test-house at a steel works, tests for discovering the elastic limit (or even the break-down point are much more difficult and tedious. When it is considered that either of these points is reached when the extension of the specimen is probably less than $\frac{1}{100}$th of an inch in a length of 6 in., it is quite evident that

any attempt to discover this limit by means of marks, no further apart than the above distance, and on pieces in process of testing to destruction, must be quite out of the question.

These tests were accordingly made by Messrs. David Kirkaldy & Son, London, on specimens 11 ft. long by 2 in. broad, and of thicknesses varying from ·737 in. to 1·515 in. This ensured absolute impartiality in the conducting of the tests, and the results incidentally furnish complete proof (if such were needed) that if elastic limit is defined as the limit over which stress and strain are directly proportional, there is hardly any stress, however low, which can be called the elastic limit. The results given below are the mean of those given by :—

(1) Two specimens of mild steel.
(2) Ten specimens of high tensile, normal.
(3) Eleven specimens of high tensile, annealed.

The third series is given, although the ship plates used in the construction were not annealed. It should also be noted in connection with the ultimate extension that it is measured over a length of 100 in., and, in consequence, the percentage extension is much less than in a specimen of 8 in. or 10 in. length. This is due to the fact that in all these lengths of specimens the local extension at the fracture would be the same.

inch of original sectional area, and high tensile steel, free from nickel, and not annealed—such as was used in the construction of the ship—should have an ultimate tensile strength of from 34 to 38 tons, an increase of 20 per cent. The normal high tensile steel is here shown to be above expectation as regards ultimate tensile strength by 2·2 per cent. and above the mild steel by over 24 per cent. Taking, however, the expected increase of 20 per cent., and with an increase of 9·7 per cent. in the ratio of the elastic limit stress to the ultimate tensile stress, we may say that the high tensile material is 32 per cent. better than the mild steel. If we take the increase for tensile strength as 24 per cent. and for elasticity as 9·7 per cent., it shows a superiority of 36 per cent.

The specimens had 25 spaces of 4 in. marked off along their lengths, and extensions were measured at increments of 1 ton load per square inch of original sectional area, and the ultimate extensions over the 4 in. spaces were recorded. These latter gave a measure of the uniformity of the strength of the material, while by the former the yield point or limit of elasticity was gauged. This seems to have been considered as reached when a permanent set of about ·01 per cent. of the original length took place.

The records show that the extensions up to the limit of elasticity were not proportionate to the stress intensities and

Fig 5

ELEVATION SHEWING EXTENT OF HIGH TENSILE STEEL PLATING ON TOPSIDES

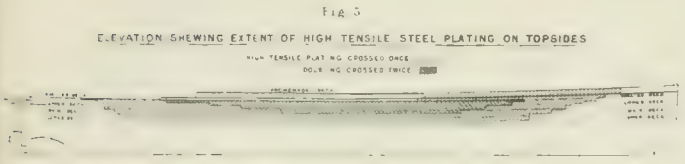


Fig 7 Plate II

CROSS CURVES SHOW VARIATIONS OF PRESSURE RATES AT POSITIONS INDICATED FOR ALL POSITIONS OF THE SLIDING WAYS

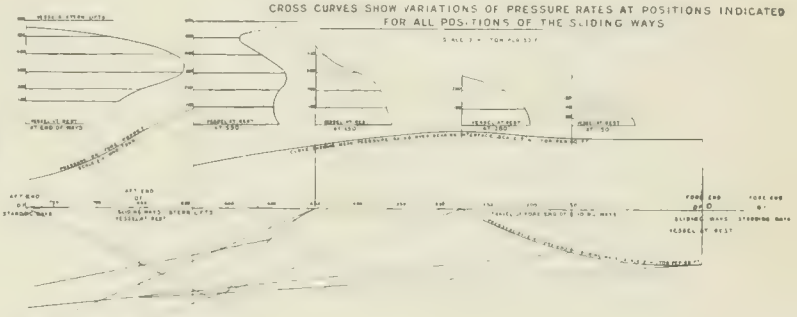
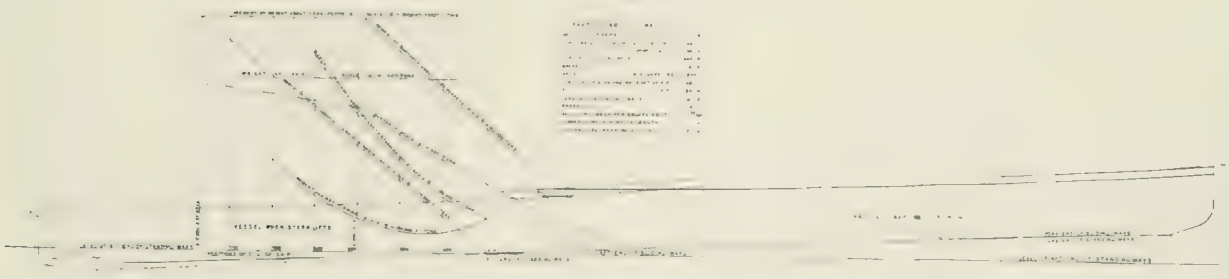


Fig 6

LAUNCHING DIAGRAM



Measurements taken over an Original Length of 100 Inches.

Description	Ultimate Extension in 100 in.	Elastic Stress per sq. in.	Ultimate Stress per sq. in.	Ratio of Elastic to Ultimate Stress per sq. in.
Mild steel	17·65	12·9	29·6	43·5
High tensile steel, normal..	13·04	17·5	36·8	47·7
High tensile steel, annealed	14·80	19·5	36·6	53·4

For the numbers of pieces tested it is seen that the average ultimate tensile strength of the mild steel is 29·6 tons per square inch against 36·8 for normal high tensile and 36·6 for annealed high tensile steel. The average ratios of the elastic to the ultimate tensile stresses to which the specimens were subjected were 43·5 per cent. for the mild steel, 47·7 for the normal high tensile, and 53·4 for the annealed high tensile.

Now, in the strength calculation, it was assumed, and so specified to the makers, that mild steel should have an ultimate tensile strength of from 28 to 32 tons per square

consequently the Young's Moduli varied according to where the stresses and strains were taken. At a small stress intensity, the value of Young's Modulus for the mild steel is 41,000,000 lbs. per square inch, and in the vicinity of the limit of elasticity falls to 31,000,000. For the high tensile steel it is 39,000,000 at a low stress intensity, and 31,000,000 in the vicinity of the limit of elasticity. These figures correspond very well in the two materials, and show that a structure composed of the two kinds of steel will be homogeneous in its character.

It was also stipulated that, besides having tensile strength as mentioned above, the high tensile steel should be able to satisfy all the other mechanical conditions and tests applied to mild steel; the elongation on a length of 8 in., and on 8 in. specimens were sometimes as high as 30 per cent., and never below 23 per cent., which compares very well with the specified minimum of 20 per cent. in mild steel. The non-temper test had to be satisfactorily met, and bending tests were conducted on 11 ft. specimens of mild and high tensile steel, and they were found to be of about the same value for withstanding flexural stresses. A series of percussion tests clearly demonstrated the superiority of the high tensile steel to the mild steel with which it was compared, and the material

was consequently accepted. As will be gathered from the previous mention of the positions in which it has been used, no furnacing or bending of plates was required.

It was considered advisable to drill all the holes in these plates and to trim up all edges in the planing machine, planing off a breadth (or length) equal at least to half the thickness of the plate in question.

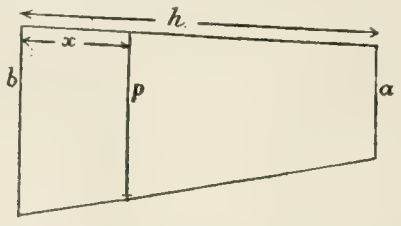
Before the keel blocks of this vessel were laid, calculations had to be undertaken to see that she could be safely launched. The line of the berthing was selected to suit the length of the ship, and so that her stern might point to the River Cart at its confluence with the Clyde.

Suitable declivities of keel blocks and launching ways were determined by a limited process of trial and error until, corresponding to certain declivities with practicable heights of blocks, a safe margin of moment against tipping was assured, and the vessel did not commence to lift until she was far down the ways. These declivities, as stated before, were $\frac{7}{16}$ in. for the keel blocks, and $\frac{5}{100}$ in. for the ways. The minimum excess of moment against tipping was 22 per cent. of the moment causing tipping at that place, and lifting occurred at 75 per cent. of the run down the ways.

When a stern lifts owing to the excess of buoyancy over weight at the aft end, as the total weight is greater than the buoyancy, there is left an unbalanced weight to be taken on the fore poppets, and communicated through the ways to the ground. The shorter the length of ways over which this weight is borne, the more intense will be the rate of pressure; if the poppets were rigid, this thrust would be located at the extreme forward end, and it is only by the yielding of the struts that this load is distributed. In the *Lusitania* this was facilitated by the fitting of soft wood packing under the poppets. This packing at the fore end was 6 in. thick, and compressed $1\frac{3}{8}$ in., and the struts themselves would also compress or crush, and so distribute the load.

A factor in the safety of a launch is the length of time the vessel has to run after the stern lifts until she drops or floats off the ways. This is especially so with long ships, as they are more liable to be canted by the action of the tide, wind, or drags. In case of this happening, it tends to cause the poppets to trip, and the fore end of the vessel to come down on the ground. The difference between weight and buoyancy can be calculated at any stage of the vessel's progress down the ways, and, if the centre of gravity of the vessel be known, and the centre through which the buoyancy acts, the centre of pressure on the ways can be found by proportion. Knowing the weight that the ways are supporting (W-B), and the surface affording this support, the mean rate of pressure can be obtained at any position of the ship on the ways. These mean pressure rates are shown in Fig. 7.

Now, if the centre of the pressure is not at the mid length of the supporting surface, the rate of pressure over this surface cannot be uniform. If, however, we assume that its variation is uniform, the curve of rates of pressure over the supporting length would be straight, and the slope can be obtained from our knowledge of the position of the centre of pressure.



If x be the distance of the centre pressure from the aft end of the standing ways, and h the distance from the aft end of the standing ways to the fore end of the sliding ways, and p the mean pressure rate over this distance, we can determine a and b from the formula $x = h\left(\frac{2a + b}{3a + 3b}\right)$, from which, since $p = \frac{a + b}{2}$, $a = \frac{6\,p\,x}{h} - 2\,p$, and $b = 4\,p - \frac{6\,p\,x}{h}$. Now, if $x = \frac{2}{3}\,h$, b will be zero; this is not a case likely to occur in fine ships. If $x = \frac{1}{3}\,h$, a will be zero, and if x is less than $\frac{h}{3}$ a will be negative, which means that there will be an upward pressure at a.

Fig. 7 has as base the distance the vessel has traversed, and the corresponding mean rate of pressure over the ways; also, the rates of pressure over the ways proportioned according to the above formulæ. This shows that when the *Lusitania* had run 280 ft. there was no pressure at the fore end of the ways, and the same occurred at 450 ft. run; between these two, the pressure at the fore end of the sliding ways tended upwards, and the amount of this tendency is shown by the curve. From where the stern lifts until she leaves the ways, the curve of total pressure on the fore poppets is shown.

The variation of mean pressure rates, as shown by the diagram, is very slight, being about two tons per square foot, from the start up till the ship has run 350 ft. The pressure rates at the fore end of the sliding ways vary during this distance from 1·5 tons per square foot positive to a slight negative pressure, and the corresponding pressure rates at the aft end of the standing ways vary from 2·5 to 4·66 tons per square foot positive. This is a much more intense rate of pressure than is apparent by merely considering the mean pressure over the length of the ways, and the tendency to upward pressure experienced at the fore end of the sliding ways has not to my knowledge been demonstrated before.

Fortunately, this intense pressure rate at the after end is prepared for by the means taken to withstand the high pressure on the ways when the vessel lifts at the stern. The pressure amounted to 19 per cent. of the launching weight at the time of lifting in the *Lusitania*, and, if taken as distributed over the fore-length of sliding ways, gives a mean rate of 10 tons per square foot. This mean rate could in turn be allocated to the ends of the length of sliding ways over which it is distributed, and in all probability would be augmented at one end and diminished at the other in the same manner as was found in distributing the pressure over the total length of sliding ways.

Curves are also shown in Fig. 7 indicating the variation in the rates of the pressure that come on various parts of the sliding ways as the ship passes over them. They are set off in terms of the distance the vessel has run. Of special interest is the one at 590ft. down the ways, the locality in which the fore-ends of the sliding ways are when the vessel lifts; also the one at the aft end of the standing ways.

Fig. 6 shows the ordinary launching diagram and gives particulars of the launching ways.

As is well known, the ship was successfully launched on June 7th, 1906; the total time which elapsed from the release of the triggers until she was fully afloat was 86 seconds; of this period 22 seconds were absorbed in tripping the keel blocks left under her, and in this operation she only progressed about one foot down the ways. This gives an average speed of 12·2 ft. per second for the remainder of the journey to the water. The velocity was so moderate that the vessel was brought up with her bow about 110 ft. from the shore, the total weight of drags in use having been 1,000 tons.

The trials will no doubt excite keen interest in technical circles, and it is to be hoped that in due course the results there obtained may be made known and discussed. No more can be done at the present time than to express a hope that they may be in every way successful, and such as will entirely justify the enterprise of the builders and the owners in the great step they have taken in assuming the responsibility of constructing these large vessels.

As our printers have not a sign to correspond with the one used in Fig. 2, which represents the word Amidships, we have indicated it by X in the text

APPENDIX.

Table of Scantlings.

Frames.—*Inside double bottom* $4\frac{1}{2}$ in. by 4 in. by $\frac{12}{20}$ in. for $\frac{3}{5}$ L X to $\frac{10}{20}$ in. joggled, and reverse frames 4 in. by 4 in. by $\frac{11}{20}$ in for $\frac{3}{5}$ L X to $\frac{10}{20}$ in joggled. *Outside double bottom* Channel 10 in. by $\frac{20}{40}$ in. by 4 in. by 4 in. by $\frac{23}{40}$ in. for $\frac{3}{5}$ L X to shelter deck, with reverse bar 4 in. by 4 in. by $\frac{12}{20}$ in. angle to Lower Orlop Deck to 9 in. by $\frac{20}{40}$ in. by 4 in. by 4 in. by $\frac{23}{40}$ in. for $\frac{3}{5}$ L X to Shelter Deck with reverse bar 4 in. by 4 in. by $\frac{12}{20}$ in. angle to Lower Orlop Deck.

Spacing.—Frames spaced 32 in. for $\frac{3}{5}$ L X to 25 in. aft and 26 in. forward.

Floors.—$\frac{12}{20}$ in. under boiler bearers and where necessary: elsewhere $\frac{10}{20}$ in.

GIRDERS.—Centre 60 in. by $\frac{20-14}{20}$ in.; G. $\frac{16-12}{20}$ in; remainder $\frac{12-10}{20}$ in. Centre girder angles: top, 5 in. by 5 in. by $\frac{15-12}{20}$ in.; bottom, 6 in. by 6 in. by $\frac{18-14}{20}$ in.; other girder angles, 4 in. by 4 in. by $\frac{12-10}{20}$ in.; margin angle, 6 in. by 6 in by $\frac{16-12}{20}$ in.

INNER BOTTOM.—Centre Strake, $\frac{16-12}{20}$ in, remainder, $\frac{15-12}{20}$ in.

ORLOP AND LOWER ORLOP.—Stringer $\frac{10}{20}$ in., faceplate $6\frac{1}{2}$ in. by $4\frac{1}{2}$ in. by $\frac{15}{20}$ in., flanged girder $\frac{8}{20}$ in. to fore and aft bulkhead.

LOWER DECK.—Stringer, 72 in. by $\frac{12-10}{20}$ in., remainder, $\frac{8-7}{20}$ in, beams channel, 10 in. by $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{10}{20}$ in. on every frame to 8 in. by $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{10}{20}$ in. according to span.

MAIN DECK.—Stringer, 54 in. by $\frac{12-10}{20}$ in.; next strake, $\frac{10-7}{20}$ in.; remainder, $\frac{8-7}{20}$ in.; beams channel, 10 in. by $\frac{20}{20}$ in. by 4 in. by 4 in. by $\frac{23}{40}$ in on every frame, to 8 in. by $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{10}{20}$ in., according to span.

UPPER DECK.—Stringer, 60 in. by $\frac{18}{20}$ in. high tensile steel to $\frac{10}{20}$ in. mild; second strake $\frac{15}{20}$ in. high tensile to $\frac{7}{20}$ in. mild forward and $\frac{8}{20}$ in. mild aft; third strake $\frac{12}{20}$ in. high tensile to $\frac{7}{20}$ in. mild forward and $\frac{8}{20}$ in. mild aft; remainder $\frac{10}{20}$ in. Beams channel 10 in. by $\frac{20}{40}$ in. by 4 in. by 4 in. by $\frac{23}{40}$ in. every frame, to 8 in. by $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{10}{20}$ in according to span.

SHELTER DECK.—Stringer, $\frac{17}{20}$ in. high tensile to $\frac{10}{20}$ in. mild; doubling $\frac{22-13}{20}$ in. high tensile; second strake $\frac{10}{20}$ in. mild, doubling $\frac{21}{20}$ in. high tensile; third strake $\frac{10}{20}$ in. mild, doubling $\frac{16}{20}$ in. high tensile; remainder $\frac{10-8}{20}$ in. mild. Beams channel 10 in. by $\frac{20}{40}$ in. by 4 in. by 4 in. by $\frac{23}{40}$ in. on every frame to 8 in. by $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{10}{20}$ in. according to span. Stringer angle, 12 in. by 9 in. by $\frac{10}{20}$ in.

SHELL.—Outer keel 50 in. by $\frac{21-15}{20}$ in.; middle keel $36\frac{1}{2}$ in. by $\frac{22-15}{20}$ in.; inner keel 58 in. by $\frac{21}{20}$ in. for $\frac{3}{5}$ L X. A strake $\frac{22-15}{20}$ in., B, C, D, E, F, G, H, J, K, L, M, N, $\frac{21-12}{20}$ in.; O, P, Q, R, S, T, U, $\frac{20-12}{20}$ in.; V, W, X, Y, $\frac{22-12}{20}$ in.; doubling to V $\frac{21}{20}$ in., extends 105 feet aft of X to 120 ft. forward of X; doubling to W $\frac{21}{20}$ in. extends 165 ft. aft of X to 160 ft. forward of X; doubling to X and Y $\frac{21}{20}$ in. for 240 ft. aft of X to 220 ft. forward of X.

Forward where the vessel is closed in, the plating is $\frac{12}{20}$ in.

F. AND A. CONTINUOUS BULKHEAD.—$\frac{9}{20}$ in. where curved; remainder $\frac{10}{20}$ in.; base angle continuous 5 in. by 5 in. by $\frac{12}{20}$ in

ANGLES.—Under decks in way of pillars 6 in. by 5 in. by $\frac{12}{20}$ in.

CALCULATION FOR MOMENT OF INERTIA.

Item	Area in sq. in.	Lever, in feet.	Moment, sq. in. × ft.	Moment of Inertia. sq. in. × ft.
Below assumed Axis, 27 ft. above base:				
Flat plate keel....	76·8	26·9	2,066	55,783
Bottom and side plating	908·4	20·6	18,713	405,000
Centre keelson....	46·8	24·5	1,146	28,090
Side girders	138·0	23·9	3,298	78,827
Tank top and margin plate	429·4	21·6	9,275	200,340
Continuous side girder	39·6	23·9	946	22,620
Side stringers	55·2	6·9	381	2,628
Bunker side	110·9	8·1	898	7,274
	1,805·1		36,723	800,562
Above assumed Axis, 27 ft. above base:				
Side plating	662·2	20·0	13,244	306,500
Lower deck	173·6	6·6	1,143	7,543
Main deck	185·9	14·6	2,714	39,624
Upper deck	291·6	23·6	6,882	162,415
Shelter deck	480·4	34·1	16,382	560,265
Bunker side	43·2	3·4	148	508
Casing bars	17·2	24·2	417	10,091
	1,854·0		40,930	1,086,946

CALCULATION FOR MOMENT OF INERTIA.

Item	Area in sq. in.	Lever, in feet.	Moment, sq. in. × ft.	Moment of Inertia. sq. in. × ft.
Deduct $\frac{1}{7}$th for rivets	309·0		6,822	181,158
Above 27 feet	1,545·0		34,108	905,788
Below 27 feet	1,805·0		36,723	800,562
	3,350·0		2,615	1,706,350
N.A. ·78 ft. below 27 ft. line, *i.e.*, 26·22 ft.			Correction ..	2,043
Lower lever, 26·30				1,704,307
Upper lever, 35·53				2
Total moment of inertia				3,408,614

In round figures, the moment of inertia in units of square inches × feet² is 3,410,000, and the bending moment in the condition, when entering port, is 1,020,000. The consequent stress per square inch on the shelter deck—in extension— is 10·6 tons, and the compressive stress on the keel 7·8 tons.

THE SCREW PROPELLER.

IX.*

BY A. E. SEATON, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

WHILE on the subject of the influence of the form of the ship on the efficiency of the screw propeller, it will not be altogether inappropriate to reproduce some further experiments made by the Admiralty after the revelations made in the trials of H.M.S. *Dauntless*, the alterations to which ship produced results which were gratifying and even startling. Six years later, *viz.*, in 1856, the new sloop—or as she would be classed now, 3rd class cruiser—*Flying Fish* was selected for a series of trials, after which a false bow was fitted to her which increased her length by 18 feet, and gave her a much finer "entrance," so much so that her prismatic co-efficient of displacement was thereby reduced from 0·677 to 0·631; the increase in displacement was not great, being only 62 tons or 5·78 per cent., and the addition to the wetted skin was not very considerable, being no more than 6·5 per cent., the mean draught of water being practically the same. As originally designed she was 200 ft. long, 30 ft. 4 in. beam, and at a mean draught of water of 11·8 ft. displaced 1072 tons and attained a speed of 11·603 knots at full boiler power. The engines, which were of 350 n.h.p., had two cylinders 58 ins. diameter and 27 ins. stroke, and developed 1161 I.H.P., and with half the boilers attained 9·923 knots and developed 577 I.H.P. While the latter result was not altogether bad the former was very disappointing, as the Admiralty co-efficient ($D^{2/3} \times S^3 \div$ I.H.P.) was only 141. With a new propeller of finer pitch the speed was increased to 11·832 knots, but the expenditure of power was so large that the co-efficient dropped to 127·3. With the false bow and the same propeller as was used on the first two of these trials, the speed attained with full boiler power was 12·572 knots, being an increase of nearly a knot (actually 0·969 or 8·35 per cent.) with an I.H.P. of 1303 or only 142 increase; the Admiralty co-efficient being now 165·9, so that the actual improvement in efficiency was 17·7 per cent.

* For Articles I. to VIII. see August to March issues.

With half the boilers the I.H.P. was 640, giving a speed of 10·409 knots and a co-efficient of 191·7, or an improvement in efficiency of 8·0 per cent. and an increase in speed of 4·89 per cent., both of which, however, are inferior to the gains at full speed. This bears out the theory that up to 10 knots speeds the form of ship is not nearly so important as at speeds above this for efficiency of screw propulsion. Now, although the gains were not to be compared with those obtained with H.M.S. *Dauntless*. They were substantial and led to the suspicion that length as well as fineness had something to do with the higher speed. (See Table XIII.)

About the time of these trials with the *Flying Fish*, some of a new class of corvette or 2nd class cruiser were launched and tried in Stokes Bay. They were 200 ft. long, 40 ft. 4 ins. beam and of about 2000 tons displacement, but when with full load to 18·8 feet, it was nearly 2300 tons. Their engines were of 400 n.h.p. with two cylinders 64 ins. diameter and 3 ft. stroke. At load draught the best speed was a little under 11 knots, and at light load under 11½ knots. These were followed by some similar corvettes with similar engines, but these ships were 25 ft. longer and consequently finer, and their design due probably to the experience gained with the *Flying Fish*. Table XIV. gives the comparative results of the trials of three of these ships and shows that with the same machinery the larger ship attained a higher speed by one knot, and that with an efficiency 25 per cent. higher at full

TABLE XIII.

Experiments with H.M.S. "Flying Fish" at Stokes Bay in 1856.

	4 Half Boiler.	7 Full Power.	12 Full Power.	20 Full Power.	24 Half Boiler.
Length, Perpendiculars.....ft.	200·0	200·0	200·0	218·0	218·0
Breadth, Extreme .....ft.	30·33	30·33	30·33	30·33	30·33
Draught of Water, Mean .....ft.	11·80	11·80	11·66	11·75	11·75
Displacement .....tons	1072	1072	1070	1134	1134
Immersed Mid-Section .....sq. ft.	277	277	273	280	280
Wetted Skin .....sq. ft.	8110	8110	8058	8560	8560
Prismatic Coefficient of Displacement	0·677	0·677	0·677	0·631	0·631
Speed .....knots	9·923	11·603	11·832	12,572	10·409
Indicated Horse Power.....	577	1161	1362	1303	640
$D^{2/3} \times S^2$ (Resistance)	10,332	14,133	14,700	17,222	11,772
$D^{2/3} \times S^3 \div$ I.H.P.	177·5	141·0	127·3	165·9	191·7
Diameter of Screw.....	13·17	13·17	13·12	13·17	13·17
Pitch do. do.	20·0	20·0	15·0	20·0	20·0
Revolutions.....	59·0	74·5	83	77·0	60·6
Slip per Cent.	14·57	20·89	3·66	17·07	12·75
Indicated Thrust .....lbs.	16,140	25,700	36,100	27,900	16,500
Do. do. .....at 10 knots ,,	16,400				15,250

TABLE XIV.

Trials of Some Corvettes of Similar Design, but Different Fineness and Length, 1857 to 1860.

	H.M.S. "Pearl."		H.M.S. "Pelorus."		H.M.S. "Jason."	
	Full Power	Half Boiler.	Full Power.	Half Boiler.	Full Power.	Half Boiler
Length, Perpendiculars .....ft.	200·0		200·0		225·0	
Breadth, Extreme .....ft.	40·33		40·33		40·67	
Draught of Water, Mean .....ft.	17·25		18·88		18·15	
Displacement .....tons	1998		2290		2220	
Immersed Mid-Section.....sq. ft.	516		578		561	
Wetted Skin .....sq. ft.	11,312		12,080		12,470	
Prismatic Coefficient of Displacement...	0·673		0·693		0·617	
Speed .....knots	11·34	8·50	10·912	9·045	12·251	9·586
Indicated Horse Power	1440	731	1408	723	1560	726
$D^{2/3} \times S^2$ (Resistance)	20,382	11,408	20,706	14,233	25,500	15,586
$D^{2/3} \times S^3 \div$ I.H.P.	160·6	138·3	160·0	178·0	201	206
Diameter of Screw	16·0	16·0	16·0	16·0	16·0	16·0
Pitch do. do.	25·0	25·0	26·0	26·0	26·0	26·0
Revolutions	54·18	40·39	55·67	44·75	60·17	47·0
Slip per Cent.	15·15	14·7	23·60	21·22	20·58	20·45
Indicated Thrust .....lbs.	35,000	23,800	32,100	20,500	33,000	19,600
Do. do. .....at 10 knots ,,	27,100		25,000		21,400	

power. At half boiler power the difference was, as might be supposed, not so great, but the efficiency of the larger ship was 15·7 per cent. higher, a respectable improvement although not so great as at full power. That this was largely due to the finer lines was accepted at the time, but we know now that the difference in length was an operative factor, for since then it has been shown on many occasions after ships have been lengthened by being cut in two amidships and a piece added that the speed has been higher, notwithstanding the larger ship and the *increased* coefficient of fineness.

Every ship, of whatever form, in its passage through the water experiences resistance which increases with the speed. The ship's motion is resisted first of all by the friction of its surface; then there is a further resistance due to its form. That is to say, in moving from one position to another a large body of water has to be displaced and replaced; and this is not done without considerable disturbance even with fine line ships, as is manifested by the waves produced at the surface. This disturbance increases very rapidly with the speed, so that at high speed it is very considerable, whereas at 10 knots in well-designed ships of even moderate size it is hardly noticeable; in fact, for all ships from 200 feet long and upwards, whose form is not unsuitable for the speed of 10 knots, other resistances compared with the skin resistance are so slight that for all practical purposes it is quite sufficient to base calculations on it alone.

Another addition to the resistance is due to the setting up of eddies in the water surrounding the ship. To these three causes is attributable the whole of the resistance that has to be overcome by the screw. It is sufficient for our purpose here to assume that the resistance of the ship within reasonable limits, that is to say, so long as she is not moved at a higher speed than that for which her form is suitable, varies as the square of the speed and consequently the power to overcome the resistance varies as the cube of the speed. As a matter of fact, up to about 10 knots the assumption of such variation is fairly accurate, and in the case of large ships even beyond that speed there is no great departure from the rule, but at higher speeds the variation is at a higher rate than the square. It has been found, however, by experience with torpedo boat destroyers that at still higher speeds the increase in resistance changes from something more than the square to a rate lower than that of the square of the speed.

The late Dr. Froude made some interesting trials with H.M.S. *Greyhound* to show what was the actual resistance of the hull of such a ship at various speeds as caused by friction, wave making, etc., but without the influence of the propeller. For this purpose the *Greyhound*, ballasted to service draught with her propeller housed, was towed by H.M.S. *Active* at various rates of speed, all of which were most carefully gauged. The tension on the tow-rope was also accurately measured by a specially devised dynamometer, and every care taken to ensure a correct result. It was found that at 10 knots the resistance or tension on the rope was 4·7 tons, which corresponds to 323 horse power, and this is therefore the net amount necessary to propel the ship herself at that speed. At her trials on the measured mile she obtained this speed with an I.H.P. of 786, giving thus a total efficiency of propulsion of only 41%; if the efficiency of machinery be taken at 0·85, the horse power delivered to the propeller will be 668, less than half of which was utilised in overcoming the resistance of the ship. The loss due to friction and edge resistance of the screw itself probably did not exceed 130 horse power, and deducting this there is still a huge discrepancy to account for, which can only be attributed to the increase in resistance caused by the action of the propellor itself in removing the pressure from the stern of the ship. This additional drag is generally called the augmented resistance of the propeller. Even at the low speeds this is a very serious item, for Dr. Froude found that the *Greyhound* could be dragged at eight knots with a force of only 2·5 tons, which corresponds to a horse power of 138, while the power developed by her own engines to obtain that speed was 400 I.H.P.

H.M.S. *Greyhound* was a ship designed for a trial speed of 10 knots, and that her form was barely fine enough for that speed is seen by examining the results of Mr. Froude's trials. At 10 knots the resistance was 10,528 pounds or 1·39 per square foot of wetted surface, which is high; at eight knots the resistance was only 5600 lbs., and in proportion to the squares of the speeds indicates a friction of 1·16 lbs. at 10 knots, which is low, especially considering that when the trials were made the copper sheathing on her bottom was old and probably rough. But perhaps the most interesting item in the series (see Table XV.) is the resistance at 12 knots, at which high speed she was towed consequent on the high power of her tug, H.M.S. *Active* of 4000 I.H.P. At that speed, which was far beyond what the *Greyhound* could have gone with self-contained propelling power, the resistance was 20,160 pounds, equal to 742 horse-power. Supposing the ship to have moved at this pace with her own engines, and their efficiency as before, they would have had to develop 1766 I.H.P.

TABLE XV.

FROUDE'S TRIALS OF H.M.S. "GREYHOUND." RESISTANCE AT VARIOUS SPEEDS.

Speed at which Towed.	Actual Resistance. Lbs.	Resistance in Horse-power.	I.H.P. of her own Engines.	$D^{\frac{2}{3}} \times S^3$	$\frac{1.25 \times \text{Wetted Skin} \times S^2}{100}$
4 Knots	1,344	16·58	50·0	1,760	1,507
6 ,,	3,136	57·76	171·0	3,960	3,393
8 ,,	5,600	137·70	400·0	7,040	6,032
10 ,,	10,528	323·15	776·0	11,000	9,425
12 ,,	20,160	742·37	1766·0	15,840	13,572

The Premier of New Zealand, Sir Jos. Ward, arrived in London in March to attend the Maritime Congress, which has under consideration several important matters in connection with trade and commerce, and also with the commercial relations of the home country and the colonies. Mr. Hislop, secretary of the Australasian Institute of Marine Engineers, was appointed to attend the Congress to represent the views of colonial—New Zealand—engineers on any points of interest. Mr. Hislop left New Zealand a week or two later than the Premier. We bid them welcome to the homeland.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Disasters.

WHETHER it be that the navigators of the great American nation are not quite as careful or competent as those of other flags one cannot tell. They are, of course, to a large extent protected from undue competition in their occupation by the country's navigation laws, and the British idea has long been that protection spells inefficiency. On the other hand it is quite allowable to argue that the Pacific is a new field for the employment of exceptionally large steamers and that the charting of its waters is not yet as complete as is that of the Atlantic. Be that as it may, there has been a terrible run of ill luck amongst the big vessels flying the American flag on the Pacific. They are, of course, four in number, and of them no less than three have been in what has at one time or another looked like hopeless trouble within the last few months. First, there was the almost simultaneous stranding of the two big sisters, *Mongolia* and *Manchuria*, of the Pacific Mail Line. These ships, as we have already seen, were both eventually floated, though with, in both instances, very serious damage. Now an apparently more serious disaster has overtaken the larger vessel *Dakota*, one of the pair of 20,000 ton vessels of the Great Northern Railroad. It is less than two years since her completion and already she is piled up on the rocks at Noshima, Japan. It would appear from the details as yet to hand that the vessel was on her voyage from Seattle to Yokohama when she ran on to a reef when travelling at a speed of about 15 knots. She thus overran the obstruction with a good part of her length and lies only partly supported amidships, with her stern up and her bows under water. Almost immediately, the Mitsu Bishi Co.'s salvage steamer *Oura Maru* was despatched to the wreck, and this fact brought hope to the hearts of the British underwriters, who are largely interested in the policies on the costly hull and valuable cargo. But these hopes were soon destined to be damped, for the news soon came that those in charge of the *Oura Maru* thought so badly of the prospects of salvage that they declined to touch the job. Captain Young of the Liverpool Salvage Association, left Marseilles on the 17th March for the scene of the wreck, but it seems very improbable that the vessel, whose bottom is evidently very seriously damaged, will ever be floated again.

Meanwhile, a large steamship belonging to the White Star Line has gone ashore in the neighbourhood of the Lizard. This is the *Suevic*—one of the five sisters specially built in 1900 for the inauguration of the Company's service to Australia. One is so accustomed to associate safety of navigation with the ships of the White Star Line that an accident to one of them comes as a shock. But, as almost at the same time an Elder Dempster liner—the *Zaria*—went ashore in the same neighbourhood, it seems extremely probable that the strong gale prevailing during the preceding days had induced abnormal currents, which took the vessels out of their courses.

As regards the loss of the Great Eastern Railway's steamship *Berlin*, at the Hook of Holland, little new has transpired, and it is perhaps desirable that discussion should be postponed till after the holding of the Board of Trade inquiry. Certain persons have suggested that it was improper to attempt to enter the Nieu Waterweg under the prevailing conditions. But against this idea may be put the fact that during all the years that this channel has been used there has never previously been a serious accident to one of the Company's vessels, and in the period covered there must surely have been occasions on which vessels have entered with perfect safety under equally unpleasant conditions. One result of the accident seems to have been that an agitation is afoot to make it incumbent upon all vessels of over 200 tons gross register to carry a rocket apparatus for use, when, owing to the fact that the wind is on shore, the land apparatus is likely to be useless.

The Hamburg-American Company.

has issued its detailed report for the year 1906. It has done well indeed, for it has not fallen far behind the record of 1905, and it must be remembered that, whilst 1905 had its profits swelled by the benefits which the Company derived from its exceptionally favourable contracts with the Russian Government during the period of hostilities with Japan, 1906 has had to depend on the usual sources of profit. It is curious to observe how, even with this good record, the Company manages to complain of the course of business in so many of the numerous services in which its fleet is engaged. What an immense organization it is! The gross tonnage of the fleet amounts to no less than 926,493 tons. If the present rate of expansion is maintained—and there is no indication of anything but increased prosperity for the Company—its fleet will soon exceed that of the whole maritime marine of France! The tone of the report is distinctly militant, and in one respect unexpectedly so. For it threatens a new trouble in the North Atlantic trade. The Cunard Company is once more the element which proves disturbing to Herr Ballin and his co-directors. Whilst we should be far from wishing to see the premier British line in any way giving way to the pressure of its big German rival, it is very much to be hoped for the sake of all concerned that some *modus vivendi* may be reached before actual war is declared between the companies concerned.

New Steamship Companies.

Several new steamship companies are spoken of. There is again talk of a new Hungarian line to New York. Then Mr. William Petersen has registered a company under the style of Petersen & Co., with a capital of £50,000. Of this concern, he is to be permanent managing director at a salary of a thousand a year with five per cent. of the net profits, to be calculated before any allowance is to be made for depreciation or reserve.

The Shire Line of Steamers is the name of a company which is to acquire the well-known fleet of Eastern liners, managed by Mr. Jenkins. It has a capital of £60,000 and the interest which the Liverpool firm of Brocklebank is taking in the development of the business is indicated by the list of signatories.

The White Star Line and Southampton.

Many steps are now being taken in regard to the institution of the White Star Company on the Solent. Representations are being made by the managers of the White Star Line to the Southampton harbour authorities as to the difficulties which vessels of the draught of the *Oceanic* and the new *Adriatic* will find from the want of depth in the Channels leading to the harbour and docks at Southampton. But as yet no effect has been given to them. For the harbour people don't much care to find the money for such an undertaking. They would prefer to see the work done at the expense of the South-Western Railway, or, failing them, the White Star Company. Indeed, it is probable that they would be glad to see the money arrive from any source—except indeed, their own pockets.

Meanwhile, appointments are being made for the Shore staff of the Company. Mr. F. J. Blake, recently assistant engineer superintendent to the line at Liverpool is to be head of the engineering department on the Solent. Captain Cameron, who has had charge of the *Oceanic* since she came out, now leaves the sea to take up the position of marine superintendent, whilst a master has been appointed to the new ship *Adriatic* in the person of Captain E. J. Smith, whose last command has been the Company's big ship steamer *Baltic*.

Big Steamships.

The White Star Company is not for long to hold the pride of having the biggest steamship afloat. For, omitting all mention of the Cunarders, *Lusitania* and *Mauretania*, there are several big German vessels in process of design. To celebrate their jubilee, the Nord Deutscher Lloyd placed an order for a 25,000 ton vessel with the Vulcan Company, at Stettin. This will apparently be a vessel of the *Amerika's* or *Adriatic's* type. Then there is the *Rotterdam*, of some 24,000 tons under construction at Queen's Island for the Holland American Company, who are much pleased and encouraged by the performances of their latest acquisition, the *Nieu Amsterdam*. The Hamburg line has several big ships on order including one of nearly thirty thousand tons of the *Amerika* type, to be built, like that favourite steamer, by Messrs. Harland & Wolff. This company has also purchased

two steamers of large size in course of construction, whilst it has ordered another pair of vessels from the firms of F. Schichau and Blohm & Voss.

The New Australian Mail Company

does not seem to find that it is getting under way as easily as its promoters imagined. There is a difficulty in placing its debentures, and some of the firms who joined in the contract have thought better of the business. The first to retire were Messrs. Beardmore, who stated as their reason for stepping aside, the fact that their connection with the new venture was inimical to the shipbuilding side of their activity. Then followed the announcement that Messrs. Vickers, Son and Maxim were also leaving the syndicate. It is said that another million and a quarter must be raised before the work of building the proposed ships can be undertaken.

Russia and Neutral Steamers in the late War.

It is somewhat remarkable that after we have been told by the Ministers of the Crown from their places in Parliament, that there have been distinct refusals on the part of the Russian Government to entertain the idea of compensating the owners and crews of the British ships sunk during the late Russo-Japanese War—the subjects of another nation have already been successful in at least two instances. Yet the fact remains that, in spite of Russia's disinclination to re-open the matter on our behalf, the owners of the German steamships, *Tetartos* and *Thea* have been awarded substantial compensation by the Russian Prize Courts.

The Future Historian

of steam navigation will have a difficult task in identifying the various components of the Fleets of the Mail Lines. Take the vessels *Servian* and *Scotian*, laid down quite a long time ago by the Queen's Island Yard for the Leyland Line. These ships after reaching the launching stage lay for a long time—almost amounting to years—off the yard in which they had been built. Then they were transferred to the Hamburg American Line. Their completion was, we were told, being pressed forward that they might go trooping for the German Government and the announcement was further made that they would in future be known as the *Berlin* and *Chicago*. Now, from the recently issued report of the Hamburg American Line—to which I have already made reference in these notes—it would appear that their names are altered to *President Lincoln* and *President Grant*. For I know of no other 600 ft. steamers than they which could have been "purchased under construction" by the great German company. Thus, these two ships, although not yet at work, have already had three names each! Similarly, we have the *Kaiserin Auguste Victoria*, whose name was changed on the stocks from *Europa*, and the new leviathan *George Washington*, whose keel is not yet laid, and who has yet had a previous name (again *Europa*) bestowed upon her mere design.

German Shipping.

The Commercial Supplement of the *Times* has recently published a most interesting article on the method by which the State Railways in Germany are manipulated to give a preference or bounty to German exports. Through rates are quoted from inland places of manufacture—and not from sea-ports—to various centres abroad, the quota of the through charge allotted to railway and to steamship respectively is never allowed to transpire. But it is obvious that when cost, freight and insurance are regarded, the German article can be sold at a profit to the foreign buyer at a price considerably below that which the British manufacturer must obtain. This preference is obviated by cutting down the amount payable to the State Railway in Germany. As the railway thus mulcted of its dues is a State institution, no loss of dividend is noted. But the Imperial taxpayer suffers, though possibly the fact that he is put under contribution to procure a market for the German manufacturer is concealed from him. Nevertheless, the system is obviously one which must injure immediately the British trader, and eventually, through his sufferings, strike at the business of the British shipowner.

The Canadian-Pacific Railway

intends, it is said, to build two larger and faster *Empresses* at Fairfield and to transfer the vessels which are at present making a name for themselves on the Atlantic to the Vancouver-Yokohama-Hong Kong route. This transfer would, of course, liberate two of the vessels on that service, and the suggestion is that these steamers would be put on the Australian line.

Passengers' Valuables at Sea.

An interesting case has recently been tried in regard to this subject. The steamship companies take care in their passenger contracts to protect themselves as far as possible against the possibility of any claims for loss being brought against them. The Orient Company tells its passengers that they must deposit their valuables with the purser, and adds that they must pay one per cent. on the value of the goods so handed over for the privilege of housing them. I am inclined to think that this one per cent. is a charge not usual with other lines. Be that as it may, a gentleman who travelled by one of their steamers put his watch—to the chain of which were attached a gold sovereign purse and its contents as well as certain other valuable accessories—into the watch pocket affixed over the berth in his cabin. During the night they disappeared, and it seemed probable that some one had taken them by putting his hand through from the ventilating shaft. As the Company refused to compensate him for the loss which he had sustained, the passenger in question brought his action against the Company. The conditions of the passenger ticket were no doubt stringent enough, but he argued that there was an implied warranty that the ship was seaworthy in a technical sense for passengers and their usual belongings. He went on then to assert that a vessel so constructed that such robberies were possible was not thus seaworthy. The Court, however, refused to accept this somewhat technical argument, and the passenger failed in his suit. Intending passengers by the Orient line will therefore be well advised to take as little as possible in the jewellery line with them, as they stand between two fires—those of the robber by night and the one per cent. collecting purser.

Messrs. Harland and Wolff

have caused the great sensation of the month by the announcement that they are about to institute a ship repairing and engineering shop on the Solent. One cannot be surprised at what is to take place when one remembers that the White Star Line is about to connect itself so closely with the port of Southampton, and when one regards the terms on which the Queen's Island firm has placed itself with the various components of the International Navigation Company. We all know that when repairing jobs have been required by vessels of the Combine at Southampton it has been necessary either to sub-let the jobs or to send men and materials over to deal with the work. Such expedients are both expensive and unsatisfactory, and it cannot be wondered at that the step now taken has come. But it may well be that if the move proves a judicious one there will in the future be found to be further developments, and that eventually the connection between Messrs. Harland & Wolff and the port of Belfast will be somewhat loosened.

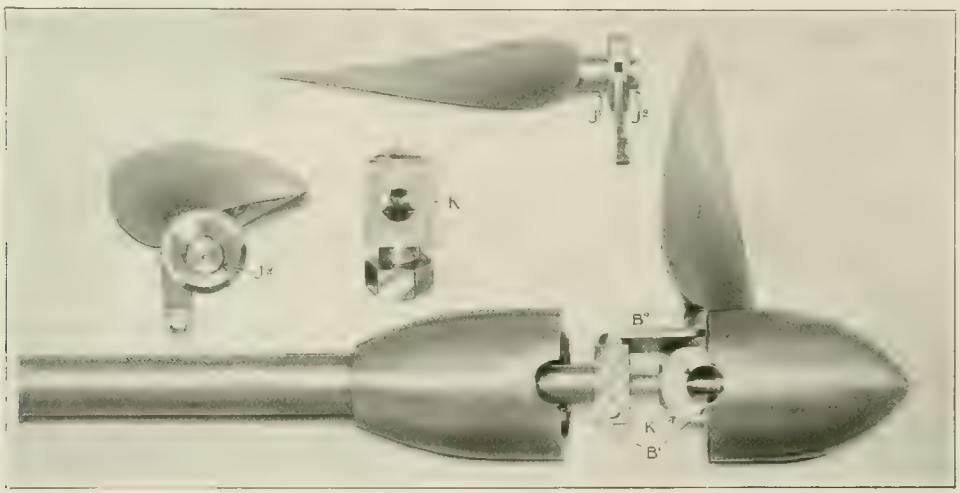
VILLINGER'S PATENT REVERSIBLE PROPELLER.

ONE of the interesting exhibits at the Commercial Motor Exhibition, held at Olympia during the past month in connection with motor boats, is the Villinger Patent Reversible Propeller.

One of the principal features sought in the design of this propeller has been increased efficiency in operating and reversing the blades, and the means by which this is attained are illustrated in the adjoining diagram, which clearly shows details of the internal construction of the propeller. The propeller is

arranged with an inner axial bearing adapted to carry a journal situated on the root of each blade so that each root flange is rigidly held and guided between this inner bearing and an outer bearing on the body of the propeller, affording substantial support at two parts and allowing the blade to revolve smoothly on its own axis in a manner similar to an engine crank working between bearings close up to the crank cheeks.

In reference to the illustration it will be noted that j^1 is an outer journal and j^2 the inner journal of the propeller blade, k is the fixed central block containing the inner bearings b^2, while b^1 designates the outer bearings in the body of the propeller. It will be recognised that greater leverage is obtained to operate the flanges at the roots of the propeller blades than is obtained in many of the reversible propellers constructed up to the present time. By the particular method of journalling the blade all tendency to cross-



Villinger's Patent Reversible Propeller.

cornering or locking of the flanges, with the resultant friction involved thereby, is obviated.

The operation of the propeller blades is effected by means of a connecting rod pivoted to the flange at one end and to a triangular shaped block at the other end, this block being carried by a sleeve sliding upon the propeller shaft.

It is worthy of note that the boss for this feathering propeller can be made practically the same length as that of the ordinary three-bladed propeller.

We think there is plenty of scope for the use of this ingenious construction, and we have no doubt that those interested in motor boat work will appreciate the merits of the device as being a thoroughly mechanical product.

Royce, Limited, Trafford Park, Manchester, manufacturers of Electrical Plant, Cranes, Hoists, etc., inform us that their firm and Messrs. Rolls-Royce, Ltd., manufacturing Motor Cars, are totally distinct and separate Companies, and should not in any way be confused with one another.

LLOYD'S REGISTER AND SHIPBUILDING DEVELOPMENT.

REPLYING to the toast of "Lloyd's Register," at the annual dinner of the Scottish Staff of Surveyors held in Glasgow on the 9th March, Mr. James Mollison, the principal engineer surveyor in Glasgow, said that he had remarked at last year's dinner that there was every probability that the gas engine would in the near future take an important place in marine propulsion. Since then many minds had been actively engaged in an endeavour to solve the problem of a gas producer capable of using ordinary bituminous coal, which could be obtained at any of the coaling ports of the world. By the use of anthracite coal the work had, on a small scale, been attended with some measure of success, and before another year had passed he thought still greater success would be obtained, and that in the Clyde district. Lloyd's committee were anxiously looking for such a development, and were prepared to give it every encouragement in its earlier or experimental stages. The year 1906 had been one of great activity for Lloyd's register. No fewer than 731 new vessels of 1,493,967 tons had been classed by the committee. According to the last published report fourteen steam turbine merchant vessels and four yachts had been built under survey and classed; while at present there were, he thought, ten turbine vessels under construction, including the *Lusitania* and the *Mauretania*.

While vessels had been growing in size year after year, the necessity had devolved upon river trusts and harbour boards not only to create new docks and harbours, but to deepen and enlarge their existing navigable channels and rivers, not to speak of canals, in most of the countries of the world. Lloyd's committee had long been alive to this problem, and had given much attention to the construction of every description of bucket and sand-pump dredging machinery and deepening plant. Many of those powerful and complicated machines, together with quite a fleet of steam hopper barges, had been built under survey and classed by the committee. The greater proportion of this work had been done on the Clyde, at Renfrew, Paisley and Port-Glasgow, and he would recommend that a special place should be found for this class of work in the society's statistical tables.

At the close of 1906 10,065 vessels of something over 19,000,000 tons gross held classes assigned to them by the committee, and in the course of a few months freeboards for 440 vessels were dealt with. Refrigerating machinery and appliances had also received considerable attention. This trade had now assumed enormous proportions. It was stated in their last report that the vessels engaged therein had a total cargo capacity of over 11,000,000 carcases, besides space for fruit and other produce.

ELECTRICITY ON BOARD SHIP.

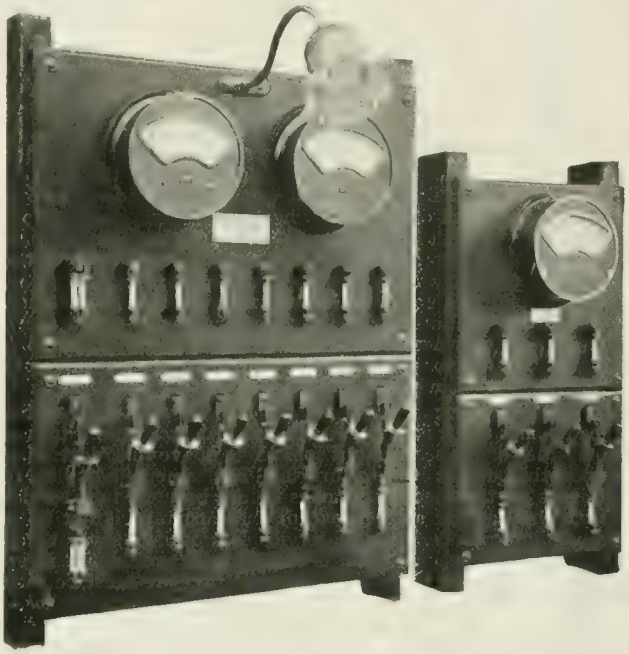
VII.*

By Sydney F. Walker, R.N., M.I.E.E., Assoc. M.I.C.E., Etc.

The Arrangement of the Dynamos in the Generating Station *(continued)*.

The Independent System.

THE object of the Independent system is the avoidance of the danger mentioned in the last article, of the individual machines becoming strained by each taking more than its proper load, owing to each obtaining the lead in the matter of pressure. With the independent system, each generator operates quite independently of all the others. There is no connection between the generators, and, therefore, there is no danger of one delivering current to the other, except in the case that will be mentioned below, if imperfect switches are employed. Each generator and its driving engine takes a certain portion of the load, but the amount is not so much under the control of the engineer in charge, as with the bus bar system. On the independent system each pair of feeders is connected directly to one of the generators, and receives current directly from it. When the load is light one machine may be furnishing the whole current required, just as with the bus bar system, and, in that case, all the feeder cables are connected to that machine. When the heavy load comes on, it is distributed between the generators by connecting individual feeders to individual generators. Thus, when the heavy load commences, where there are several generators in the station, one of them is run up to speed, its pressure brought up to that of the service, and one of the pairs of feeders is switched on to it. If the load comes on very rapidly, and it is desired to ease the machine that has been taking the light load still more, before a third machine has been run up, a second pair of feeders may be switched on to the second machine, temporarily, but this is not done if it can be avoided, as the less switching that is done on the independent system the better. When the third machine has been run up to speed and its pressure brought up to that of the service, one or more of the feeders is switched on to it, and so on. The only command the engineer has of the distribution of the load between the generators is through the divisions of the feeders. If the feeders are divided up very much, he is able to divide the load almost as he wishes, between the generators, but if the feeders are few, he can only divide as far as they will allow him. Thus, if there are, say, four machines in the generating station, each capable of furnishing 75 kilowatts, or the equivalent of 100 h.p. in electricity, and the maximum load is, say, 200 kilowatts, which three machines can take care of very comfortably, leaving one machine for spare—and suppose there are four pairs of feeders, between which the load is distributed, approximately evenly, two of the machines will take 50 kilowatts each, and one of them must take 100 kilowatts, and be overloaded to the extent of 25 kilowatts. Or if there are five pairs of feeders, each taking approximately a fifth of the load, two machines will have to take two-fifths of the load each, say, 80 kilowatts, and the other only 40 kilowatts. The remedy for this is, of course, to run more feeders, but on board ship this is not always convenient, and more feeders mean more switches, and more chances of breakdown. With the bus bar system the engineer, as explained, could easily divide the load evenly between all the machines, say, 60 kilowatts or 65 kilowatts to each of two of them and the remaining 70 or 60 to the other, and he could easily change the amount of the load on each machine, as explained in the last article. With the independent system, also, the engineer has no chance of tempering the wind to the shorn lamb. He cannot ease a machine that is showing signs of wanting to be overhauled, except to the extent that his feeders will allow him; he can only take it off, if the feeders do not give sufficient relief. It is the greater convenience of the bus bar system that has made it so universally employed. On the other hand, where attendance is not convenient to the extent required by the bus bar system, and where machines *must* be allowed to run by themselves, with an occasional look round for oiling, the independent system is the *only* possible method to avoid disaster, and somewhat frequent burn-outs. The arrangements for switching with the independent system are very similar to those for the bus bar system, when there are several generators in the station, up to a certain point. Thus, where there are more than two machines the most convenient method is to have one bus bar for the negative sides of all the generators, and for the negative cables to connect to. Each negative terminal and each negative cable is connected to this negative bus bar, by a switch, so that it can be completely disconnected from the switchboard and everything on it. The positive connections are arranged, where there are more than two machines, by a special switch, made something on the lines of the grating of a ship's hatchway. There are a number of substantial brass or copper bars fixed vertically, one for each generator, and a number of similar bars fixed horizontally, one for each feeder or *vice versa*. Where the bars cross each other, holes are drilled through the two, and in the holes plugs are inserted, connecting the two together, when switching is done. The positive terminal of each generator is connected, by a switch, to its own bar in the grating, and the positive cable of each pair of feeders is also connected by a switch to its own bar.



Two Bus bar switchboards for one small installation, made by Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.

When a particular pair of feeders is to be connected to a particular machine the plug is inserted in the hole connecting the bar of that machine with the bar of that feeder. When the connections are to be changed, when a pair of feeders are to be switched from one machine to another, as when the load is coming on, or going off, the plug is withdrawn very quickly from the hole it is in, and very quickly placed in the hole making the new connection. This is one of the disadvantages of the independent system. It is *absolutely* necessary to break the connection completely, between the machine that is furnishing current and the feeder, before making connection between the feeder and its new machine, and this necessarily makes a wink, very noticeable in the lights furnished by the feeder that is being switched. The reason why it is so necessary to completely break the connection between the machine and the feeder, before making the new connection to another machine is the same as the reason for the use of the independent system, the possibility of the coils of the machine to which connection is being made, forming a path for current, from the other machine, or *vice versa*. If connection between the second machine

* For Articles I. to VI., see last six issues.

and the feeder is made, before the connection to the first machine is broken, one of the machines, the one that has the highest pressure, will deliver a current through the others' coils, and if it is a compound machine, the current in the series coils will be in the reverse direction to its proper magnetizing current, with the result that the magnetism of the machine receiving the current will be reversed, the direction of the current it generates will also be reversed, and trouble will follow, as the positive terminal of that machine will now be negative, and its own positive will be connected to the negative bus bar. With only two machines both cables are sometimes switched from one machine to another, by a double pole switch, at one operation, and this is better, but so far as the writer is aware no method has been devised of switching the two cables simultaneously where there are more than two machines in service. For two machines the usual arrangement is to have a two-way, or, as the Americans call it, a "Throw-over" switch, consisting of a moveable contact bar with two sets of contacts, to which it can be connected. One form of the arrangement is, the contact bar stands out at right angles to its switch base, when the switch is not in use, and the two sets of contacts are fixed on the base vertically one above the other, so that when the contact bar is moved up it meets one set, and when it is moved down it meets the other set. With double pole switches there are two contact bars and two sets of contacts. In switching over, the contact bar is pulled very quickly away from the contacts it is making connection with, and very quickly thrown into contact with the other set. It will be seen that by this arrangement complete disconnection must take place, and there is no chance, unless the switch is out of order, or is improperly designed, for connection between the two machines. For board ship work, the wink in the lights mentioned is a small price to pay for immunity from the possibility of frequent burn-outs, but the bus bar system is much better where it can be arranged. There is often a good deal of sparking when switching is in operation, especially with the grating form of switch, because it is not practicable to arrange to open a switch, as it can be with the bus bar system, when there is no current passing through it. As will be explained later all sparking is bad for switches, as it tends to burn away their working parts, and a spark always passes whenever a switch is opened, the spark being approximately in proportion to the current and pressure that are present when the switch is opened.

When bringing a new machine into service, say, as the load comes on, it is necessary to bring its pressure up to, not only that of the service, but something above this, depending upon the current it is to furnish. The same rule applies to this as to the machine that is being brought into service with the bus bar system, except that accuracy is not of so much importance. If the service is working, say, at 100 volts and the machine that is coming in is to take a load of, say, 50 kilowatts, or 500 ampères, its pressure must be such that it will deliver the 500 ampères at the 100 volts *when connected*. Thus, if the resistance of its armature and series coils, if it is compound wound, are together 0·01 Ohm, the pressure it must furnish without load will be 105 volts. This is another slight disadvantage of the independent system. When the incoming machine is switched on to its feeder it will adjust itself immediately to the load, delivering the current through the cables, lamps and motors that its pressure says it must, and if the pressure is slightly different, as it may easily be, from that of the machine that is being disconnected, the lamps will feel the difference. There will be a slight difference in the current delivered to any motors that are being supplied by the particular feeders, but that will be inappreciable, while the difference in the light given by the lamps will be distinctly felt, especially down below on board ship. There is no help for this, however. Even where two machines are exactly alike in every respect, and furnish exactly the same pressure at the same speed, when the current is going out, the incoming machine will nearly always differ from the outgoing, because the coils of the latter will be warm, and their resistance will be increased, and hence the charge for the passage of the current through them will be increased. It is very unusual to find two machines exactly alike, in the sense that they furnish the same current at the same pressure, when running at the same speed. In the writer's experience you may take two machines made from the same billets of iron and copper, by the same hands, from the same design, and they will come out slightly different. The pressure will be slightly different at the same speed, or the speed for the same pressure will differ. In addition, every engineer knows how difficult it is to make two engines keep *exactly* the same speed. Modern improvements have done a very great deal to alter this, but there is still some of it left.

The illustration shows two bus bar switchboards for one small installation. The writer will explain the arrangement of main switchboards in the next article.

SHOP MANAGERS AND FOREMEN AND ENGINEERING PROGRESS.

THE West of Scotland Foremen Engineers' and Draughtsmen's Association held its tenth annual dinner in the Grand Hotel, Glasgow, on the 9th March, at which about 170 gentlemen were present. Mr. Wm. Brown, of Messrs. Wm. Simons & Co., Renfrew, presided, and supporting him and among the general company were Mr. Robert Duncan, M.P. (Messrs. Ross & Duncan, engineers, Govan); Colonel John Denny and Mr. Peter Denny (Messrs. Denny and Co., Dumbarton); Dr. John Inglis (Mesrss. A. & J. Inglis, Pointhouse); Mr. James Gilchrist (Messrs. Barclay, Curle & Co., Whiteinch); Engineer-commander Jenkins; Mr. H. E. Hollis, Mr. Jas. Brown, Mr. R. Scott, Mr. Wm. Davie, Mr. Finlay Ross, etc. To the toast of "The Imperial Forces," proposed by Mr. Robert Davison, Engineer-Commander Jenkins and Colonel John Denny responded appropriately.

In proposing "The West of Scotland Foremen Engineers' and Draughtsmen's Association," the chairman said the association was instituted in 1897. Its members consist of managers, foremen and chief and leading draughtsmen, connected with the different branches of the engineering trades in Glasgow and district. The purpose of the association, as stated in its constitution, was the bringing together of those engaged in the direction and superintendence of engineering works for better acquaintance, and for promoting the exchange of opinions by discussion of papers submitted by members and friends. Nothing better could be desired if they were to go on improving in their shop methods and appliances in the future as in the past, so that they might be able to hold their own successfully against the keen competition they had to meet more and more from foreign countries. Foremen's Associations in the past had been productive of much good in the direction aimed at by their own association, and a number of the partners, managers, draughtsmen and foremen of well-known engineering firms had in their day been connected with such associations. With very few exceptions the oldest of them had passed away, but the services rendered by the old pioneers and the well-earned reputations which they gained for themselves were recognised by all.

As illustrating the rapid progress which had been made within a comparatively short period, the chairman said he was struck by a remark his father had made when he was told of his (the chairman) being asked to preside on that occasion. He remarked how great the developments had been since he first attended Foremen Engineers' suppers in Glasgow. He was then actively engaged as a foreman himself with the construction of "side-lever," "beam," "geared," and "oscillating" engines, and with boilers of 20 lbs. pressure. These, of course, had given place, in time, to "direct-acting" engines and in 1865 to "compound" engines, and again in 1880 to "triple-expansion" engines, and high-pressure boilers which had since the latter date been greatly developed. Progress, at least equally rapid, had been made with the introduction of the steam turbine for the propulsion of vessels. From the practical beginning made in 1894 when Parsons' "turbinia" was the first vessel fitted with turbines, this type of propulsion machine had rapidly come to the front, and especially so since 1901, when the *King Edward*, the first passenger steamer fitted with turbine machinery, was constructed on the Clyde. Now, scarcely six years later, there was building on the Clyde turbine machinery of the most powerful description for war vessels and gigantic ocean mail steamers. All this had been accomplished during the lifetime of a man who was still in business.

and who was still taking a lively interest in all these latter-day productions. Equally important and rapid had been the advance made in other departments of engineering throughout the country. The introduction of water-tube boilers fitted to the war vessels recently built and those now under construction marked a sign of the times, although all present might agree that the old Scotch boiler would die hard, and that it still commanded the best attention for vessels for the mercantile marine. Engineering invention and progress, however, must still go on. Gas-producing plant to take the place of the steam boiler has made some advance, and this was the subject of a recent address by so experienced an engineer as Mr. Jas. McKechnie, of Barrow-in-Furness. Oil engines also were rapidly coming to the front for land installations. and threatened also to take a prominent place in the propulsion of vessels, while oil-fired steam boilers were becoming common.

Speaking of the progress made in one branch of ship-building and engineering which had made a home for itself on the Clyde and district, the chairman remarked that very special demands had been made, more particularly of late years, by dock and river authorities at home, and in all parts of the world, for special dredging plant to deepen rivers, remove bars and deepen dock entrances, to meet the demands made on them by shipping companies who were providing themselves every year with vessels of increasing dimensions and draught of water. In early days this work was done by small stationary bucket dredgers with a limited dredging capacity and from shallow depths. Now we had this type of dredger increased in dredging capacity to lift several thousand tons per hour from 50 feet depth of water, and suction pump dredgers of great power which were able to lift sandy material at the rate of many thousands of tons per hour in specially good lifting material. The types of dredging vessels and plant now employed to deal with local requirements were very varied in their character, and called forth all the resources of the various firms employed in their construction. He was not giving away a secret when he stated that it was the intention of the Mersey Docks Board very shortly to order a suction dredger of extraordinarily large dimensions, and with a dredging capacity to raise sand from the river bed of the Mersey at the rate of 10,000 tons per hour.

After referring to the progress made in locomotive engineering and electric tramway and road motor car services, the chairman said we might well say "What next?" It was quite possible that in the near future we may find ourselves hesitating, whether to take a train, a tramway or an aërial car to reach our destination. The latter mode of transit was engaging the serious attention of some people, and perhaps when, by-and-by, such appliances were perfected, they might be able to take long aërial flights, or, for a time at least, to shake their feet clear of the dust of the earth which had now become so serious a nuisance on country roads. On behalf of all employers he acknowledged the good the association was doing. The relations which should exist between every employer and his manager, draughtsmen and foremen should include the consideration of their interests as identical, and for this reason, among others, he strongly urged upon his employer friends, who were not already enrolled, to become honorary life members of the association.

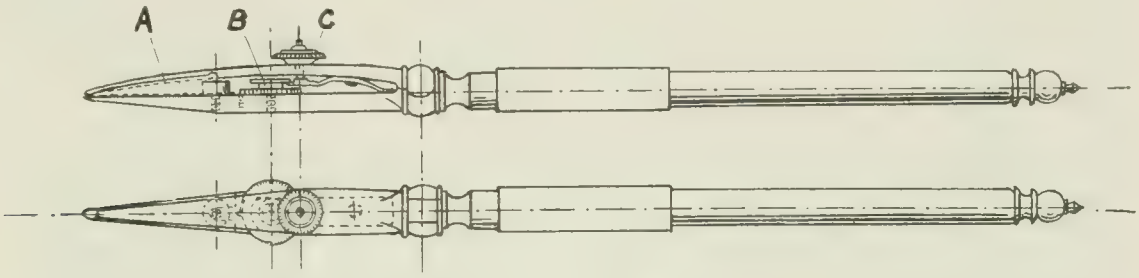
Other toasts were "The Houses of Parliament," proposed by Mr. H. E. Hollis, responded to by Mr. Robert Duncan, M.P.; "The Corporation of Glasgow," proposed by Dr. John Inglis, responded to by Lord Provost Bilsland. To the further toast of "The Clyde Engineering Industries," proposed by the latter, Mr. James Gilchrist and Mr. Alex. Cleghorn suitably replied.

SAMUEL'S PATENT DRAWING PEN.

THE quality of work capable of being executed by drawing pens is affected by two important factors, one the condition of the pen as an instrument, and the other the condition of the ink in the pen. A proper condition of the instrument, of course, is maintained by the handicraft of the individual who sharpens the marking devices or pen points. But the condition of the ink in the pen is one which has to be left to the draughtsman using it.

In order to properly clean pens made on the old-fashioned lines it is necessary to disturb the adjustment, remove the adjusting screw and open the pen legs so as to clean or scrape deposit which continually forms between the legs. This not only absorbs time, but is very objectionable, owing to the necessary readjustment.

We have pleasure in illustrating a new improved drawing pen which is now being put upon the market,



Samuel's Patent Drawing Pen.

the object of the construction of which is the improved quality of the lines drawn with a great saving of time. This pen is illustrated in two positions in the adjoining diagram, from which it will be seen that the pen is fitted with a fastening arrangement, by turning the milled nut B of which a quarter of a turn, permits the pen to be instantly opened and closed before and after cleaning or ink filling without disturbing the adjusting screw C, thus enabling uniform and clear lines to be drawn without loss of time adjusting, trying pen, etc.

The point of pen is similar to an ordinary one, but in addition is fitted and used with (or without) an enclosing steel nib A, of channel section which receives and permits the hinged leg of pen to be adjusted within its sides for the width of line required. This nib, which is removable for cleaning, etc., in the same way as the ordinary writing pen nib, holds and encloses the ink free from evaporation so that the pen can be used on fine line work for over two hours without cleaning or refilling, a result which astonished the inventor, and gives the agents confidence in offering to sell them on approval.

These pens are being put on the Market by the Union Drawing Office, St. Vincent Street, Glasgow, who are the agents of the Inventor, Mr. B. L. Samuel of Glasgow.

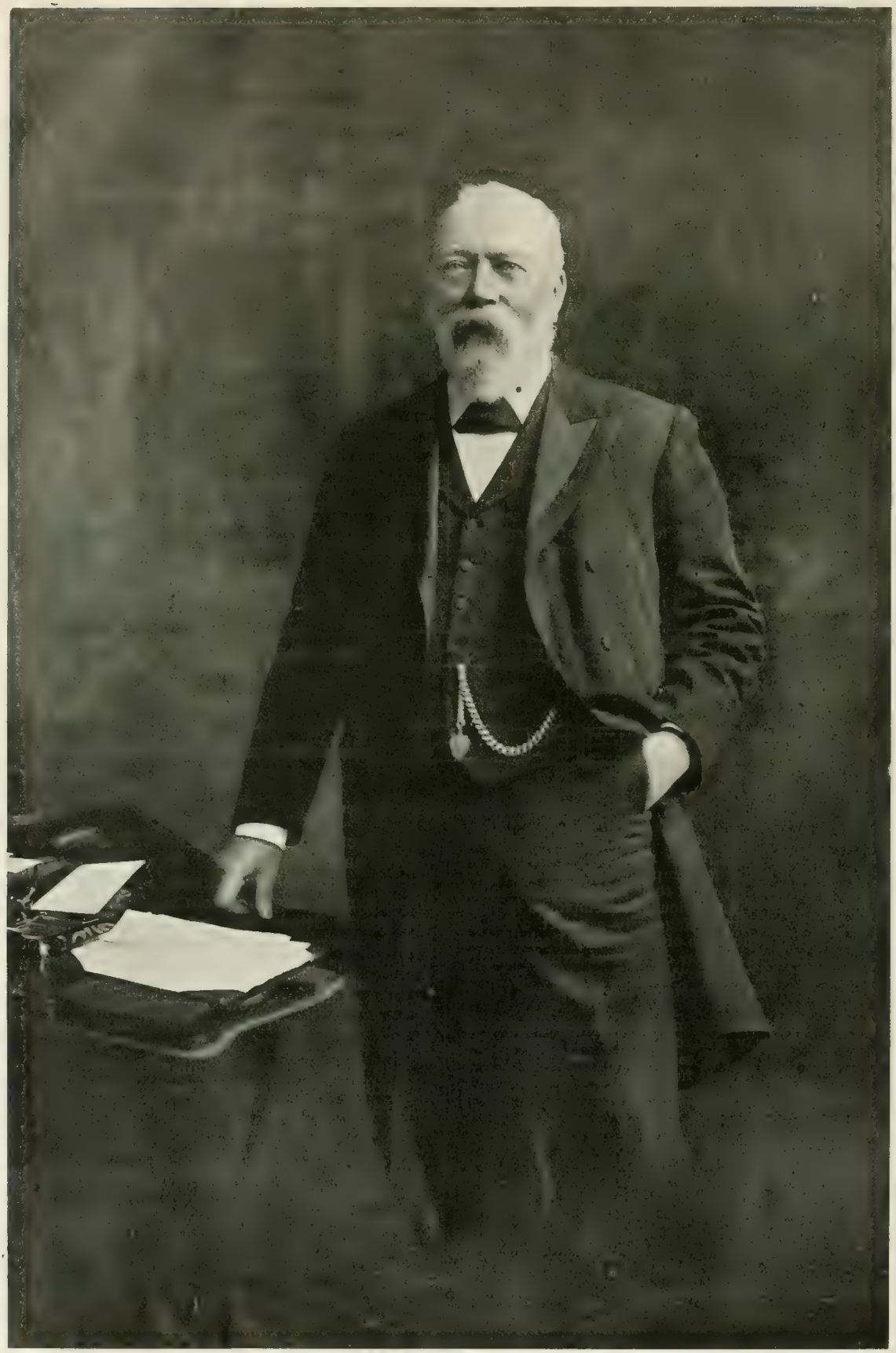
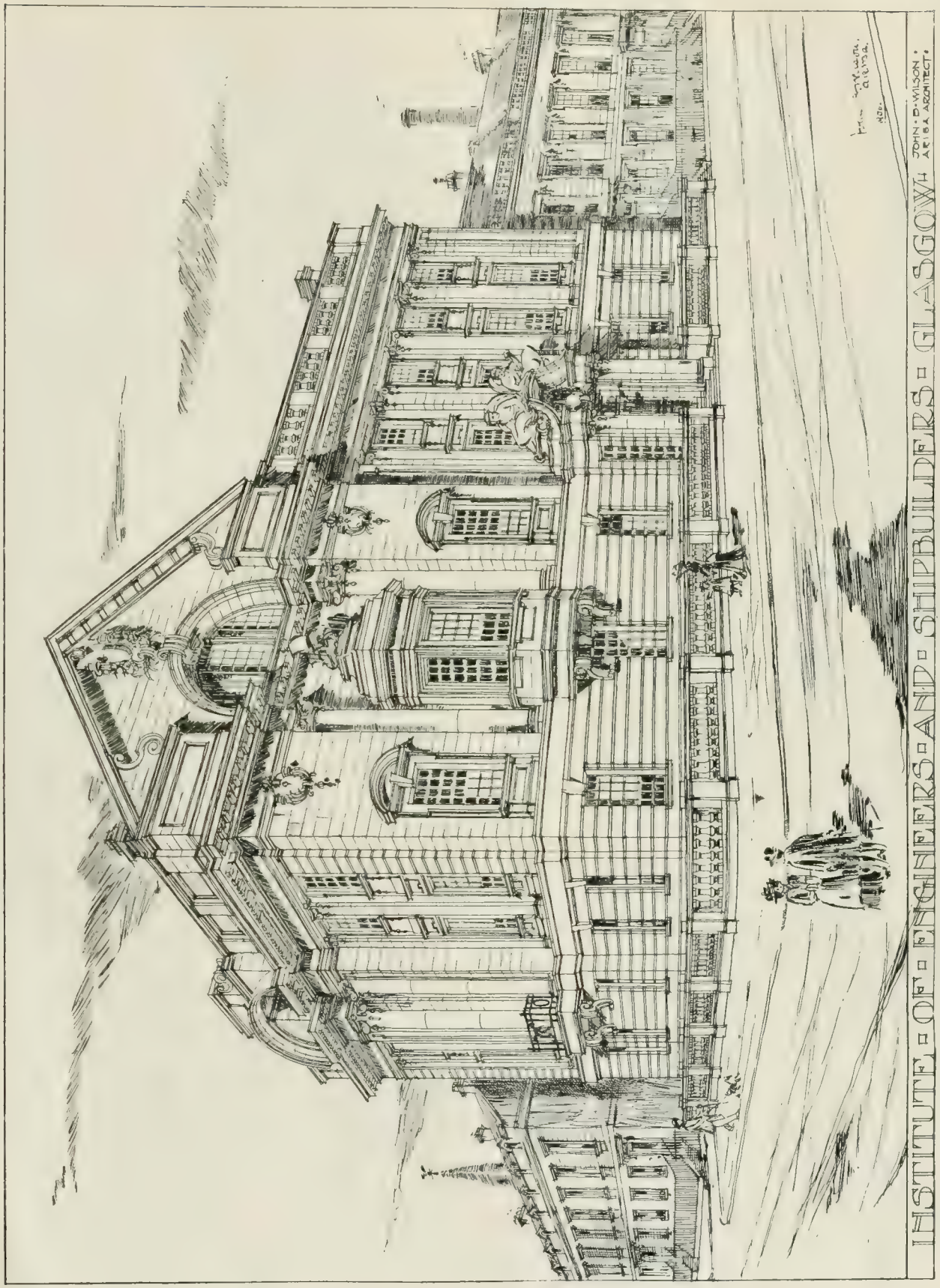


Photo by Lafayette, Ltd., London.

James Gilchrist, Esq., President of The Institution of Engineers and Shipbuilders in Scotland.


INSTITUTE OF ENGINEERS AND SHIPBUILDERS GLASGOW
JOHN D. WILSON
ARCHITECT

THE INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.

(By our Clyde Correspondent.)

THE forth coming ceremonial laying of the foundation stone of the fine new buildings to house the Institution of Engineers and Shipbuilders in Scotland, and the other celebrations appropriate to the jubilee year of this body, makes it fitting that our readers should be presented with a picture of the new buildings, together with a portrait of the gentleman who at present occupies the presidential chair of the institution, Mr. Jas Gilchrist, who is chairman of Messrs. Barclay, Curle & Co., Ltd., Shipbuilders and Engineers, Whiteinch.

The Institution was founded on 1st May, 1857, and its origin was due chiefly to a very successful summer meeting of the Institution of Mechanical Engineers, which had been held in Glasgow the previous year. The Institution of Mechanical Engineers was founded about ten years before, and at that time had its headquarters in Birmingham, and this Glasgow visit was the first of the series of summer meetings which it had held. Many of the leading engineers of Glasgow and neighbourhood attended this meeting, and it seemed to them that in such an important engineering centre there was ample field for a Scottish Society, and more particularly if it embraced all classes of engineers as well as shipbuilders and founders. Some preliminary meetings were held, and at the meeting on May 1st, 1857, a constitution was adopted, and office-bearers elected, and so "The Institution of Engineers in Scotland" came into existence. The first president was Professor W. J. Macquorn Rankine, of whom it might almost be said that he founded the Institution, as the energy and enthusiasm which he brought to bear on its inauguration went far to establish it on a permanent basis.

In 1860, "The Scottish Shipbuilders Association" was founded, and conducted for five years with great success. It was then amalgamated with the Institution of Engineers and the two societies met as a united body for the first time on 25th October, 1865. A joint meeting of the two societies was held in the Queen's Rooms, Glasgow, on 26th April, when the amalgamation was confirmed and office-bearers elected, Mr. James Gray Lawrie, shipbuilder, being chosen president of the United Societies. At the meeting held on 7th July, 1870, the name of the Institution was changed to its present form, "The Institution of Engineers and Shipbuilders in Scotland," and its first meeting as an incorporated body was held on 31st October, 1871. At this meeting (it may be noted) a memoir of Mr. John Elder was read by Professor Rankine. Mr. Elder was elected president for the 13th session, but died on 17th September, 1869, about a month before the opening of the session. At the meeting on 23rd December, 1873, a considerable accession was made to the graduates' section by the admission of the members of a society called "The Association of Engineers in Glasgow," thirty-six in number. This society originated in 1860, under the name of "The Association of Assistant Engineers in Glasgow," and only engineers in situations were eligible; but some years later the word "assistant" was left out of the title to enable some of the members, who had commenced business, to continue their membership.

For the first eleven years the meetings of the combined bodies were held in the Andersonian University, George Street, and for the following twelve years in the Corporation Galleries, Dalhousie Street, Glasgow. After many preliminary meetings and negotiations, a special meeting was held on 20th August, 1878, at which it was agreed to proceed to erect a building, jointly with the Philosophical Society of Glasgow, and this was done, the result being the rooms at 207, Bath Street, where the first meeting was held on 2nd November, 1880.

At the meeting on 20th December, 1887, it was announced that the annual dinner in celebration of the birth of James Watt, which had formerly been held under the auspices of "The Association of Foremen Engineers," would, by a mutual arrangement, be held in future under the joint auspices of the Institution and the Philosophical Society. Accordingly, the first celebration under this arrangement was held during January, 1888. The Institution and the Philosophical Society alternately made the arrangements till 1893, and subsequently, the celebrations have been managed entirely by the Institution. These annual re-unions have been highly successful. The attendance has always been numerous, affording a pleasant meeting of friends from all parts of the country. The James Watt dinner is permanently established as part of the proceedings of the Institution.

Since its foundation in 1857 the Institution has had twenty-five presidents, the first, as already stated, being William John Macquorn Rankine, C.E., LL.D., Professor of Civil Engineering and Mechanics, Glasgow University, who was a second time elected to the chair in 1869-70. In the presidential list is found the names of men who were, and are, not only distinguished men of affairs in connection with the industries of shipbuilding and engineering, but also of eminence in professional and educational circles. The second to fill the presidential chair was Walter Montgomerie Neilson, and in the course of the years, others more identified with marine engineering and shipbuilding, although the Institution is representative of all other branches of engineering—were James Robert Napier, engineer and shipbuilder; James Morris Gale, C.E., Glasgow Corporation Waterworks Engineer; David Rowan, marine engineer; Robert Duncan, shipbuilder; Hazleton Robson Robson, marine engineer; Robert Mansel, shipbuilder; James Thomson, LL.D., Professor of Civil Engineering and Mechanics, Glasgow University; William Denny, shipbuilder; Alex. C. Kirk, marine engineer; John Inglis, LL.D., engineer and shipbuilder; Sir William Arroll, engineer and bridge-builder; Robert Caird, LL.D., shipbuilder; Archibald Denny, shipbuilder.

The present holder of the office, as has been stated, is Mr. James Gilchrist, marine engineer, who was elected in May, 1905. Born in Glasgow in 1847 and educated mainly at Partick Academy, Mr. Gilchrist immediately after leaving school was apprenticed to marine engineering with the firm of which he is now, and has been for some years, chairman. Established by Robert Barclay in 1818, at Stobcross, Finnieston, this concern was in 1845 augmented by the admission of Messrs. Robert Curle and James Hamilton, the title becoming Robert Barclay and Curle. Other partners were subsequently admitted, and in 1855 the present premises, or their neucleus, were acquired at Whiteinch. One of those taken into partnership was Mr. Arch. Gilchrist, father of the subject of our notice, who from the first had charge, especially of the machinery department. While serving his apprenticeship, Mr. James Gilchrist entered himself as a student at the evening classes of the Mechanics' Institute, the predecessor of the Glasgow Technical College, thus equipping himself with the theoretical as well as the practical side of his profession. Mr. Gilchrist was soon appointed to be chief of the drawing office, a position which he occupied for eight years or so, evincing such keen interest in, and appreciation of his work, that the full charge of the engineering department, up till then held by his father, was put into his hands. A few years thereafter, Mr. Gilchrist was offered and accepted a partnership in the firm, still retaining as his special care the managership of the engineering branch. A keen appreciation of every new development and a determined adaptation of them to their own special province has resulted, under his hands, in making the engineering branch of Barclay, Curle and Co. fill the high place it occupies to-day.

During the earlier years of its history, the Institution had as secretary, Mr. Edmund Hunt, then for a much longer period, Mr. W. J. Millar, C.E., himself an author, and known more especially for his editorial work in connection with the various editions of the published works of Dr. Macquorn Rankine. Retiring in 1896, the post of secretary became vacant and the present holder, Mr. Edward H. Parker was elected. Mr. Parker had a dockyard training, and subsequently was on the staff of experimentalists under the late Dr. William Froude, of the Experimental Tank at Torquay, now established at Haslar. For some seven or eight years prior to his appointment as secretary, Mr. Parker was on the special staff in the experimental tank of Messrs. Wm. Denny and Bros., Dumbarton. Co-incident with his appointment, a keener interest in, and a resolute endeavour to improve, the standing and influence of the Institution were evinced by many of the members. The tale of progress and development on these lines has been continuous ever since. The membership has gone up by leaps and bounds, the meetings have been more and more numerously attended, the interest and quality of the papers read have been greatly enhanced, the discussions

more lively and more worthy of the subjects submitted, and the annual volume of transactions resulting therefrom of decidedly greater value. The editing of the transactions is part—and of course not the least responsible part—of the secretarial duties. All branches of engineering—civil, mechanical, electrical and locomotive—as well as marine engineering, steel manufacture, and shipbuilding (in which of course, Glasgow and the Clyde are most deeply interested) have due attention accorded to them in the proceedings and published transactions of the Institution.

Increasing membership and library and reading room exigencies, compelled attention to the insufficiency of the accommodation provided in the rooms, which the Institution shared with the Royal Philosophical Society. As Dr. Robert Caird remarked in his presidential address of October, 1900, this arrangement when it was entered upon was an admirable one in the interests of both societies, but it had now survived its usefulness. "While it was always painful to break up an old partnership, and particularly so in the present case in which the two societies have invariably co-operated with mutual forbearance and an ever increasing cordiality, still the question of a separate and more suitable establishment is becoming urgent and must shortly be faced."

The council of the Institution made arrangements with the council of the Royal Philosophical Society for the sale to that society of the Institution's half share in the buildings at 207, Bath Street. A special committee on new buildings was appointed two years ago, and after full consideration, a site for new premises was secured at the corner of Elmbank Street and Elmbank Crescent, nearly facing the High School of Glasgow. The site has been cleared of existing buildings, and a start made with the construction of the new edifice, the foundation stone of which will be laid, it is hoped, by Lord Kelvin, one of the oldest—as he certainly is one of the most eminent—members of the Institution, on the first day of May. Architects practising in Glasgow were invited to prepare plans for the new buildings, and 51 responded to the invitation. After receiving the report of the assessor, Mr. G. Washington Browne, of Edinburgh, the plans of Mr. J. D. Wilson, Bath Street, Glasgow, were accepted as best fulfilling the requirements of the Institution. From the sketch of the elevation plan, which we are enabled to give in this number, it will be seen that architecturally the building will be a fine example of the later English Renaissance, and the construction generally will be of a fire-proof character. The cost of the buildings with site, etc., will be between £25,000 and £30,000. Apart from the funds otherwise available, a number of members—partners in well-known engineering and shipbuilding establishments on the Clyde—at an early stage signified their willingness to contribute substantial sums to the fund for defraying the cost of and thoroughly setting in order the Institution's handsome premises. Internally these will be arranged with lecture halls, ante-rooms, council room, library, reading and secretarial rooms, on a scale adequate to the demands, and worthy of the Institution, whose membership is now altogether some 1600 strong. The accommodation provided also will partake somewhat of the character of a club where members may meet and confer in a social as well as a business and professional way.

ELECTRICAL NOTES.

(From our Own Correspondent.)

THE subject of the electrical applications to shipbuilding berths has become a prominent feature in recent years, in fact, no up-to-date berth is considered complete unless the new arrangements are embodied in their construction. Our competitors abroad have not been behindhand in these matters and have thereby cheapened the building of vessels and quickened their delivery, two most important features in these competitive days. It is not therefore out of place to consider a little closely the general principles on which improvements have been made and chief among these is perhaps the cableway for transporting pieces over a vessel during construction and dropping these pieces into place just where they are required. The system primarily consists of three cables, which convey carriages along the line of the vessel and well above her. The three carriages have also a combined cross traverse to take in the full width of the vessel. The structure on which these cable carriages work surrounds the berth, the ends being anchored and arranged angled outwards to provide for stability against the loads carried. The cable span has to be sufficient to take in the length of the ship being built and the cables on which the carriages work are $7\frac{3}{4}$ in. diameter, while those that tie the end supports are $5\frac{1}{2}$ in. diameter. Energy is conveyed to the carriages by means of six electrical cables, three of which run on either side, making contact with projecting collectors on the trolley. The speed of travel is 650 ft. per minute and the hoisting speed 160 ft. It is evident that full control can be obtained with such an arrangement as the above and the working is of the most expeditious kind. In this country the system is fitted at Messrs. Palmer's, of Jarrow. Another form of apparatus seems perhaps more familiar, being of the electric derrick type. It is only to put up several of these at intervals apart to be able also to compass a shipbuilding berth. Loads of 5 tons are lifted in this way 120 ft. from the ground level at the rate of 90 ft. a minute and a radius of 35 ft. Another strong competitor to these systems is that of cranes of the overhead travelling type, necessitating on each side of the berth a gantry upon which the travellers run to command the whole area of the ship. Ordinary walking cranes are fitted also so that their jibs can swing round over a vessel being constructed. The overhead travellers carry a working load of 15 tons, the speeds at full load being 40 ft. per minute lifting, 500 ft. per minute travelling and 220 ft. per minute traversing, while the walking cranes have a lifting load of 5 tons at a radius of 30 ft. These latter types are in use at Messrs. John Brown Co.'s works. While we are all familiar with hydraulic riveting, the electric variety is in the field. In this case the connection being made, the motor spindle revolving, causes the encircling nut to lift and carry with it the lever which actuates the press for the rivet head. Energy is cut off automatically as soon as the riveting is finished, the nut running back to its lowest position. One man only is required and a rivet is put in in one second and it is said to be suited for hot rivets from $\frac{3}{8}$ to 1 in.

Electric lamps have been much before the public lately, the flame arc lamp taking a very prominent place, but apart from the advantage of energy consumption and luminous efficiency, there are certain drawbacks, chief of which is the rapidity of consumption of carbon, price and troubles occasioned by the salts the carbon are impregnated with. The success these lamps have obtained has induced trials of magazine holders to avoid the difficulty of the rapid consumption of the carbons. The mechanism for the purpose before us is of a very ingenious character and consists essentially of two downwardly inclined carbons linked together at their upper ends so that they fall down at the same time and promote equality of burning. This is, however, rendered possible by the pliable nature of these carbons when heated by the arc. Various methods have hitherto been employed for separating the carbon ends in an arrangement of this kind when the arc is struck. Clockwork has been general for the purpose, in combination with shunt and series coils, the former pulling the ends together when the current is switched on and a series coil opposing pulls them apart. Clockwork is recognised as unsatisfactory and the form referred to has been devised, which enables one or more pairs of carbons to be set so that their upper ends are held in guides inclined at the same angle as the carbons, the holder of each pair of carbons being linked together to a central guide piece, which enables both carbons to fall together equally. Without a drawing it is impossible to describe the mechanism employed, but the shunt and series coils are utilised again, the lamp starting with its carbons together, the carbon holders being caught under hooks for trimming and then released. With flame lamps, it is necessary to provide for extinguishing when the carbons have burnt completely away and a short circuit switch is used which comes into action when the voltage across the carbons exceeds the normal, the effect being to extinguish the arc, which then strikes another pair of carbons, if any be available. In the standard construction of this lamp, two pairs of carbons give a 28 hour life. The arrangement has to be such that no metallic salt vapours can reach the mechanism in any way, which is essential for successful working of this class of lamp. The Reason Manfg Co., of Brighton, is putting this type on the market at the present time.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondents.)

Portsmouth Dockyard.

THE work provided for us in the Estimates for the coming financial year appears sufficient to keep the yard fully employed without the necessity for any large discharges. We are to build one of the new battleships, but only £211,200 is to be spent on her during the coming year, and as only £40,000 is for dockyard labour the vessel cannot be commenced until about December. As the *Bellerophon* will be launched by July there will be four or five months of slack time to be provided for. Although good progress is being made with the *Bellerophon* the order against overtime is still strictly enforced. Our share of repair work is five large vessels—the battleships *Glory*, whose refit is to cost £54,932; *Canopus*, £25,498; and *Goliath*, £48,418, and the cruisers *Ariadne* £53,338, and *Berwick* £17,364. The torpedo depot ship *Hecla* is to be overhauled at a cost of £22,782, and several destroyers are to be repaired, those on which the largest amounts are to be expended being the *Crane* £6848, *Coquette* £6889, and *Porcupine* £6902. The refit of His Majesty's yacht *Victoria and Albert* has been completed and on March 19th she left for Marseilles, where the King will embark. Not only has the yacht been redecorated, but many improvements have been carried out. The steering gear has been readjusted and a new electrically worked capstan has been fitted to the after part of the vessel, while among other innovations is an electrical oven for baking Vienna bread for the use of the Royal travellers. The King's new yacht *Alexandra* is expected to be delivered here by Messrs. Inglis, Glasgow, in September, when she will take the place of the old yacht *Osborne*. An improvement which will be much appreciated is about to be carried out. A number of telephone boxes are to be erected on the jetties. They will serve as call offices and also be points to which ships lying at buoys in the stream may connect wires, and so place themselves in telephonic communication with the shore.

Devonport Dockyard.

Our prospects as indicated by the Estimates are very bright. The average number of men employed here last year was 7000, whereas the number now employed is about 9400, or only a thousand below the highest total ever reached by us. Little is known as to the new battleship we have been allotted save that she will not be commenced until very late in the year. The construction of the *Temeraire* is to be expedited and the total expenditure on the vessel from January 1st last to March 31st next year, not including the cost of armament and ordnance stores, will be £1,092,058, and of this £845,072 will be spent in the year commencing on April 1st, £106,000 of this latter amount being for dockyard labour. According to latest arrangements the date provisionally fixed for the launch is August 20th. In the construction of the vessel such progress has been made that it would be possible to launch her at a much earlier date, and when that event does take place she will have reached an exceptionally advanced stage. The estimated expenditure on the cruiser *Minotaur* during the coming year is £355,519, £70,000 being for dockyard labour. The total amount spent on the vessel will then be £1,340,206, excluding armament and ordnance stores. As the progress of the vessel advances it is seen that the Admiralty have embodied in her some of the lessons of the war in the Far East. The conning tower is smaller and is of 12-inch hardened steel. The searchlights are more powerful, there being eight new pattern 36-inch projectors. Another innovation is her net defence, she being the first cruiser to be so fitted. She is also being fitted with hot and cold shower baths for all sections of the ship's company. The vessel is to be ready for commissioning by October 1st. Of the rents to be taken in hand there have been allotted to us five cruisers and four destroyers. The biggest job will be the cruiser *Niobe*, on which £40,000 is to be spent, while a sister ship, the *Andromeda*, is to come from Chatham to be refitted at a cost of £29,268. The other cruisers are the *Cornwall* and *Cumberland*, £10,580 each, and the *Gibraltar*, £28,289. The four destroyers are the *Arab*, *Leopard*, *Fairy* and *Osprey*, each of which will be refitted at a cost of £6333. The cruiser *Essex* has joined the Portsmouth Division of the Home Fleet. Her after repair trials were very satisfactory, the officials in charge being quite satisfied with the performance of both her engines and Belleville boilers. The battleship *Commonwealth*, which is having the damage she sustained in collision with the *Albemarle* off the coast of Portugal temporarily made good at Gibraltar, is expected here daily. She will probably be in dockyard hands four months. I hear from Gibraltar that a large hole was made in the *Commonwealth's* port bow by the *Albemarle's* ram, and this necessitated the removal of several plates, which have been replaced by special 2-inch steel plates.

The New "Battleship-Cruisers."

The *Indomitable*, the first of the *Invincible* class of armoured cruisers, was launched from the establishment of the Fairfield Shipbuilding Company at Govan by the Marchioness of Breadalbane on March 16th. Sir William Pearce, the chairman of the Fairfield Company, speaking at the luncheon subsequently, said the details of the vessel must remain a mystery until her official trials, or at least until the Admiralty thought fit to inform the public. One thing he would say, the *Indomitable* was an enormous advance on the last armoured cruiser H.M.S. *Cochrane*, built and engined at Fairfield. Rear-Admiral J. E. Bearcroft, C.B., M.V.O., admiral superintendent of contract-built ships, in the course of a short speech, said he was confident that the vessel, should occasion arise, would carve out for herself a record which would live in the annals of naval history. Of the sister ships the *Invincible* will be launched on April 13th from the works of Sir William Armstrong, Whitworth & Company, Newcastle-on-Tyne, where she was laid down on April 2nd last year. The other vessel, the *Inflexible*, was to be launched on March 30 at Clydebank by Messrs. John Brown & Company. These vessels are practically identical. The length is 530 ft., breadth 78 ft. 6 in., and mean load draught 26 ft. The coal capacity is 1000 tons, and they will carry oil fuel. They are of 17,250 tons displacement, with turbines of 41,000 horse power, which are to give a speed of 25 knots, and their main armament will consist of eight 12-inch guns. The cost of each vessel will be roughly one and three-quarter millions sterling. Ostensibly cruisers, they will be able to engage battleships, for they will be the largest, swiftest and most heavily armed cruisers of any of the world's navies. Indeed, they are more heavily armed than many battleships. Of the appearance of the hull of the *Indomitable* a correspondent gives the following description:—For some 10 or 20 feet the sectional lines of the stem are almost parallel; and thence to the full breadth of the vessel some two-fifths of the length is accounted for. Only a very few feet are occupied by the full beam when the lines begin to narrow, and at the point where the casing of the outer propeller shafts emerge from the hull the vessel is again unusually narrow, and for a considerable length one can see that the screws will be moving in dense water.

Chatham Dockyard.

The principal subject for discussion is, of course, the programme of work for Chatham as shown in the Estimates. As was generally expected, no large vessel has been allocated to us, and for the first time for a very long period we shall be in the unenviable position of having no large ship on the stocks, whilst one only—the cruiser *Shannon*—will be in course of completion. All that we are to receive in the way of new construction are two tugs, two lighters and some submarines. These will probably be two of the latter craft, as only £6000 is to be spent on them for labour and £8000 for materials. Taking things as a whole, however, we shall be in about the same position as last year, when the sum voted for labour on new construction was £142,650, divided between the battleship *Africa* and the cruiser *Shannon*, repairs and refits being £84,100, making a total of £226,750. This year the figures are:—Repairs and refits, £116,150; new construction, £110,395; total, £227,545. The biggest refits will be the torpedo vessel *Vulcan*, which is expected next month from the Mediterranean; the cruiser *Diadem*, now on her way home from China; the cruiser *Hawke*; the *Blenheim* and

Blake, which are to be fitted as depot ships for torpedo boat destroyers; and the depot ships *Leander* and *Tyne*. The estimated sum to be spent on the battleship *Dominion* is about £37,000, including expenditure up to date. The removal of the wood sheathing from the bottom and sides of the vessel shows that she sustained severe damage. There are several large indentations in some of the plates, while the inner frames are much bent. Most of the bottom plates will have to be renewed, as will also many along the sides, and at a moderate estimate the vessel will be in dock quite another three months. Three destroyers are to be refitted, the *Salmon*, *Snapper* and *Sunfish*. The cruiser *Medusa* has arrived here from the Motherbank, she is to have her boilers removed and they are to be placed in the *Vulcan*. There is to be a sale here on April 9th of several obsolete war vessels, and other craft, including the battleships *Sans-pareil* and *Conqueror*, the armoured cruiser *Undaunted*, the torpedo gunboat *Alarm*, the coastguard watch vessel *Frolic*, the destroyer *Skate*, the special service vessel *Wave*, and the watch vessel No. 21. The three first-named vessels will be sold subject to their being broken up within the United Kingdom, and the *Alarm* must also be broken up, but not necessarily within the United Kingdom.

Sheerness Dockyard.

Although the Estimates have been reduced by nearly a million and a half sterling, it is expected that there will be quite as much work for this yard as during the past year. The sloops *Vestal* and *Rinaldo* are to be taken in hand for conversion into gunnery ships, and several destroyers will come in for retubing. The formation of the new Fourth Destroyer Flotilla, with Dover as its base, should be of some benefit to us, for defects are certain to develop occasionally which will necessitate the vessels being sent to the nearest dockyard. The enlargement of Nos. 4 and 5 Docks is now nearly completed, and this will place the yard in a better position as a destroyer refitting establishment than it has been for some time. The new Home Fleet at the Nore will have as the flagship of the battleship squadron the *Dreadnought*, which is due here on March 31st, from the West Indies, the other vessels being the *Bulwark*, *London*, *Victorious*, *Magnificent* and *Majestic*. The four new armoured cruisers of the *Warrior* class—the *Achilles*, *Cochrane*, *Natal* and *Warrior*—will constitute the Fifth Cruiser Squadron, together with the *Leviathan* and the *Duke of Edinburgh*, which has flown the pennant for about a year in the Second Cruiser Squadron. The cruiser squadron will be the most powerful under the White Ensign, or for the matter of that under any other flag. The adjustment of the main bearings of the cruiser *Bedford*, the metal of which "ran" at her trial, having been completed, the vessel left on March 7th for China. She was to have left on February 16th, but her departure had to be deferred. Such detentions of commissioned ships are very rare in these days of preparedness. The *Diadem*, which the *Bedford* is to relieve, will probably be home by the time this is published. As I forecasted last month, Rear-Admiral Startin is to leave us in consequence of his promotion to flag rank. The new captain-superintendent is Captain Casement, who comes on May 4th. It is quite certain that he will not put in his full time here, for he is only fifteenth down the captains' list, and in these days of rapid promotion it should not be long before he reaches flag rank. The eighteen junior rear-admirals have been promoted since April 1st of last year.

The French Naval Disaster.

The French Navy has been most unfortunate of late. On February 12th the cruiser *Jean Bart* stranded on a reef between the Agal and Virginie Rocks, on the coast of Barbary, North-West Africa, and according to latest advices has been abandoned, all hope of refloating her having been given up. Fortunately, however, the crew managed to get ashore. The *Jean Bart* was one of the oldest vessels in the French Navy. She was launched in 1889, and had not been on active service for six years before being sent out in January to replace the *Jurien de la Graviere* on the Atlantic station. Almost the same day that the news came of the *Jean Bart* being abandoned, a lamentable disaster occurred on board the battleship *Iena*, which was in the Missiessy Dock at Toulon. On the morning of March 12th men had been engaged in the store rooms packing shells with amianthoid, a sort of asbestos, in order to prevent them striking against each other when the ship rolled. Upon resuming work after luncheon two explosions occurred and flames burst out. The force of the explosions was so great that men on deck were hurled into the dock, which was dry, while those at work in the immediate vicinity were blown to fragments. Shells flew through the air, setting the buildings alongside the dock on fire and causing great devastation. Out of a total of 630 officers and men 114 were killed and about the same number injured. The cause is at present unknown, but it is supposed to be due to the high temperature of the magazines and the age of some of the powder. The Iena, which was the flagship of Rear-Admiral Manceron, was to have put to sea the following day. She was one of France's finest battleships, having been launched in 1898 at Brest and completed in 1901. Her displacement is 12,000 tons and she has engines of 16,500 horse power, giving a speed of 18 knots. It is only just over a year ago that the cruiser *Sully*, 10,000 tons, ran on an uncharted rock in Along Bay, Indo-China, and became a total wreck. There were no lives lost and her guns and much material were saved. Then there were the two submarine disasters at Bizerta —the *Farfadet* and *Lutin*—while since the beginning of the present year three boiler explosions have occurred. The monetary loss to France in about a year may be put down at quite three millions sterling, for it is quite certain that the Iena will never be fit for use again as a fighting unit.

Pembroke Dockyard.

It has been officially announced that the *Defence* is to be launched on April 27th, and as it will be high water on that day at six o'clock, the launch will probably take place at half-past five. The Countess of Cawdor, wife of the First Lord of the Admiralty in the late Government, will name and launch the vessel. Lady Cawdor promised to launch a previous ship at this yard, the *Warrior*, I believe, but was unexpectedly prevented from doing so. The *Defence*, which will be the two hundred and fortieth vessel launched here, will have been two years and two months in hand—quite a long time in these days of record breaking. She will, however, be in the very forward state and all her side armour will be in place, as will also the armour of her ten 7·5-inch guns, barbettes and the armour tubes communicating with the magazines and shell rooms. The shipment of the armour forming the fore barbette will be deferred until after the the launch, but that forming the after barbette has been put in board. The acceptance steam trial of the *Warrior* will, according to present arrangements, take place on April 9th, but the 7·5-inch gun trials will probably have to be postponed until after the vessel has been docked, as it is said to be impracticable to adjust the sights while the ship is afloat. We are not very satisfied with our share of the nation's work for the coming year, for the reason that the estimated wages bill is to be £46,007 less. This certainly appears as if Pembroke is doomed to gradual extinction. The expenditure for labour on the *Warrior* and *Defence* is to be £10,000 and £70,000 respectively, while the amount put down for our new "mother ship" is £39,000. She is officially described as a "new, fast, unarmoured cruiser," and is to be named the *Boadicea*, a name which disappeared from the Navy List some years ago. Her principal dimensions, as given in the Estimates, are:—Length, 385 feet; breadth, 41 feet; mean load draught, 13 feet 6 inches; displacement, 3300 tons. No particulars as to the weight of hull, power of engines, speed, coal carrying capacity, or armament are given. The length stated is between perpendiculars, the over-all length being 405 feet 9 inches. Writing to a correspondent with reference to a description of this yard by him in a recent speech as "moribund," Mr. Arthur Lee, M.P., who was Civil Lord of the Admiralty in the late Government, explained that he had used the word because the policy of the present Government obviously suggested that it was their intention to make it so. The last Board of Admiralty had no intention to allow Pembroke to dwindl down or to die out. The present Government did not propose to spend a single penny on improvements. The late Government had given orders to Pembroke for armoured cruisers of the largest size, but the only vessel allotted by their successors had been a small fast cruiser, the type of which he understood to be obsolete.

ON THE TRAINING OF CADETS FOR THE MERCANTILE MARINE.*

(*Continued from page 297.*)

By J. Denholm Young, Member.

THE methods available for engineering apprenticeships do not appear to be equally suitable for sea apprenticeship, *e.g.* :

(*a*) The sandwich system, of summer at practical work, and winter at study, would probably not appeal to those who can admit apprentices to their ships.

(*b*) Then, to postpone study until the end of the regulation four years at sea has been shown to lead to cramming and intellectual stagnation.

(*c*) Several years of sea service being evidently necessary before a youth could be in any case qualified to act as second mate, the most natural solution of the difficulty appears to be found in such institutions as the training vessels *Conway* and *Worcester*, where cadets may get two years' good general education combined with technical training in nautical matters before going to sea, so that when his turn comes for promotion it will not be a case of cramming, but of putting into practice solid experience already in his possession.

This fact is recognised by the Board of Trade, which allows the two years passed on either of these vessels to count as one year off their sea apprenticeship, in addition to which there is no doubt, that youths passing out of these vessels can generally obtain better appointments in the mercantile marine than those who only serve the ordinary sea apprenticeship.

Taking the *Conway* as an example: the syllabus informs us that "cadets intending to enter the merchant service are instructed in navigation, nautical astronomy, trigonometry, compass deviation and meteorology, up to the stages required for the extra master's certificate." They are also instructed in English history, geography, French, arithmetic, algebra, science and ambulance work, besides extra subjects.

A glance at the daily time-table and a short reference to the standards reached, will show how the various subjects are dealt with. The diagrams show the hours per week spent in each subject in the various branches of instruction.

In both the junior and senior divisions, navigation, nautical astronomy, and seamanship are given a larger number of hours per week than any other subjects, while arithmetic, algebra, geometry, trigonometry, geography, English, French, etc., are each given their due share of attention.

Athletics are strongly encouraged, and practical ship's duties, down to washing the decks, are faithfully and regularly performed. The cadets also all receive practical instruction in carpentry.

The technical subjects, it need not be stated, are taught in practice as well as in theory, and no youth who has honestly attended to his instruction on these vessels and who keeps up the knowledge he has learnt, need be afraid to face the Board of Trade examinations.

The physical development of the lads is carefully attended to, so as to produce a type of officer sound in body as well as sound and well-trained in mind, while the art of maintaining a firm, yet kindly, discipline is learnt in the routine of daily life, as well as from the practice the boys themselves obtain in taking charge of boat crews, etc.

The stage to which instruction is carried is illustrated in the specimens from examination papers appended, and when it is borne in mind that "cramming" is altogether avoided, this appears to leave little to be desired.

The *Conway* is also fortunate in possessing a naval department, from which a selection of cadets is sent yearly to enter the Royal Navy.

The candidates for naval cadetships are received at an earlier age and spend a considerable amount of their time in the engineering workshops on board, at the vice and lathe and at patternmaking, moulding, etc., as required by the Admiralty, whether they intend to qualify for deck officers or as engineers.

It is here that the writer ventures to think an improvement could be introduced into the generally accepted training for the mercantile marine.

Life, it is true, is not long enough for every officer to have all the experience necessary to make both a good captain and a good engineer. The wooden ship has gone, however, and the mechanically constructed steel hull has taken her place. Sails have gone and mechanical propulsion has taken possession of the sea. The hand windlass, hand capstan, hand winch, hand steering gear have gone, and steam, hydraulic or electric machines, all more mechanically constructed than the older apparatus, have taken their places. Is your deck officer, who was well-trained in sails, ropes and tackle and carpentry, to have no mechanical training as regards vital parts of his modern deck machinery?

It seems to the writer a great want, and he has seen the want of this knowledge have ill consequences for the deck machinery of fine vessels.

The science and theory of the steam engine need not be required or expected of deck officers, but with so much elaborated machinery beyond the control of ships' engineers, there seems to the writer little doubt that an elementary training in the strength and properties of metals, in the general use of hand and machine tools and smith-work, and in the care of the particular machinery under their control, as well as in the construction and care of parts of the hull, would be a decided benefit to themselves and to the service.

Recently the Board of Trade has abolished the examination in "lunars" for "extra masters" and established "naval architecture" instead, a step evidently advisable, considering the present relative value of the two branches of knowledge.

But why should "extra masters" be the only officers supposed to understand the construction of the ships they navigate?

Practical (apart from theoretical) naval architecture is, to anyone on board ship, a much simpler study than trigonometry or nautical astronomy, and it seems to the writer that the total sum of an officer's useful knowledge could be increased without over-exertion, if the more abstruse and difficult subjects were mastered at a good nautical school, as they are mastered on board the *Conway* and *Worcester*, with the aid of continuous and skilled instruction before going to sea; and then at sea the easier subject of practical ship construction could be read up by any junior officer without expert tuition, and with plenty of actual examples around him.

In the olden days of wood and sail, the navigating seaman had more opportunities, perhaps, of "knowing his own ship" than he has now, and it appears a pity that in the transition from sail to steam, the training of the deck officer has not been so thoroughly provided for as the training of the engineer, except in the Royal Navy, and there only very recently.

This Institution has an interest in the subject, inasmuch as it contains members who build these steamers, and who must desire them to be well manned and well taken care of. It also contains shipowners, whose interest it is that the training of their officers should be thorough and not superficial; it contains members who have had experience at sea in command of ships themselves, and who have good reason to have opinions of their own; and it contains authorities on education whose experience in teaching would assist in arriving at practical conclusions, conclusions which the writer cannot but think will not coincide with the generality of present practice, but which, whether they agree with the views stated in the present paper or not, will point towards a needed improvement in the general facilities for training and educating deck officers of the British mercantile marine, facilities, which, except in the case of the *Conway* and *Worcester*, are at present not worthy of a great profession in a great seafaring nation.

* Read before the N.E. Coast Institution of Engineers and Shipbuilders.

PATENT ALUMINO THERMIC PROCESS.

IN our last issue we gave detailed particulars of a demonstration of Thermit welding, which was to be given at the works of the Thames Iron Works Engineering and Shipbuilding Co., Ltd., at their yard in Blackwall. We had the opportunity of personally witnessing the demonstration, and we are pleased to report that the stern frame was successfully welded with 4 cwt. of Thermit compound. The frame was set up and the mould was built up round the stern frame at

that portion where the joint was to be made, and the part was pre-heated by a coke stove in which was a fire blown up by an electrically-driven blower. After three-quarters of an hour of this pre-heating treatment the parts were approximately red-hot and the charge of Thermit compound was ignited by the application of a fuse to a small portion of igniting powder placed on the compound and the re-action took place. After a very short space of time, the bottom of the crucible was opened and the Thermit iron, which was then at a temperature of something more than 4,000° F. was allowed to flow into the mould around the parts to be welded. In the course of three hours or so the joint was stripped of its mould and on examination a satisfactory junction appeared to have been made.

Later on two pieces of a large U-section casting were joined in the same way, 8 cwt. of compound being utilised for the purpose. We should like to take this opportunity of congratulating the Company on the success of their demonstration, and to express the hope that the utility of the process will be appreciated by those interested in shipping matters, whose pockets are likely to be saved by this simple and effective method of carrying out repairs without involving the large amount of cutting out work which generally obtains in such circumstances.

STOCKLESS ANCHORS FOR MOTOR BOATS, SHIPS' LAUNCHES, &c.

TO meet the demand for a reliable anchor suitable for small craft, which has arisen owing to the many motor boats now building, Mr. Wasteneys Smith, Newcastle-on-Tyne, is making his well-known patent stockless anchor in small sizes specially designed for this purpose, from a few lbs. upwards.

These Anchors possess many advantages over the ordinary stocked anchor, and have proved very

satisfactory, as is evinced by the many repeat orders received from owners and builders.

It may be mentioned that the British Government have for some years past been adopting outfits of the Wasteneys Smith anchor in all their new battleships, cruisers, &c., and other Governments are following suit. The new Royal Yacht Alexandra, now almost ready for launching, will also carry three of these anchors, and H.M.S. *Indomitable* will be fitted with an outfit of patent stockless anchors weighing about 6½ tons apiece, similar to her sister ships the *Inflexible* and *Invincible*.

EXPERIMENTS WITH DR. SCHLICK'S GYROSCOPIC APPARATUS FOR STEADYING SHIPS.*

By Sir William H. White, K.C.B., F.R.S., LL.D., D.Sc., Honorary Vice-President.

THE transactions of the Institution for 1904 include a paper by Dr. Otto Schlick "On the Gyroscopic Effect of Fly-wheels on Board Ships." When it was read Dr. Schlick exhibited a series of models illustrating the principles of his proposals, and an interesting discussion followed. The models then used were of small inertia, in proportion to the inertia of the gyroscopes mounted in them; and it was explained by the author of the paper that their steadying effect was consequently extreme At the same time Dr. Schlick stated his opinion—based on his own investigations and confirmed by other investigations made by Professor Föppel—that gyroscopic appliances having dimensions and weights suitable for adoption in ships would render it possible to control and limit the rolling motions of large ships when exposed to the action of ocean waves. Dr. Schlick anticipated that the period of oscillation of ships might thus be increased considerably, while the extreme angles of inclination reached in rolling might be largely reduced.

Since the paper was read, Dr. Schlick has given continuous attention to the subject. Recently he has carried out a series of valuable experiments in the *See-bar* (formerly a first-class torpedo boat of the German Navy) in which an experimental gyroscope has been installed. Having had the opportunity of witnessing the behaviour of this vessel in rough water, I have undertaken (at the request of Dr. Schlick, and on his behalf) to place before the Institution a brief summary of results obtained, and of conclusions derivable therefrom. It will be understood that Dr. Schlick accepts full responsibility for the facts stated hereafter; but from personal observations I am in a position to certify to the remarkable steadying effect of the gyroscope. When I was on board the *See-bar* the state of the sea unfortunately was such that we did not experience the heavy rolling which would have illustrated fully the advantages obtainable from gyroscopic apparatus. On other occasions, however, suitable conditions were encountered, and the extinctive effect of the gyroscope was demonstrated conclusively. Still-water rolling experiments have also been made and have confirmed experience gained at sea.

The general arrangements and form of the *See-bar* (in longitudinal and transverse section) are illustrated by Fig. 1. The principal dimensions are as follows:—

Length at the water-line (about)	116 ft.
Extreme breadth	11·7 ,,
Mean draught	3·4 ,,
Displacement	56·2 tons.
Metacentric height	1·043 ft.
Period of oscillation (double roll: with gyroscope at rest)	4·136 secs.

The position in which the gyroscope is fitted (in a compartment before the boiler room) and the space occupied by it are illustrated in profile and cross-section in Fig. 1. The details of the gyroscope and its attachments to the hull of the vessel are indicated in Fig. 2. It would have been preferred to use electric power for driving the fly-wheel; but no electric generators were available on board the vessel, It was decided, therefore, to make use of steam; the periphery of the fly-wheel was provided with rings of blades, the wheel being enclosed in a steam-tight cast-iron casing and worked as a turbine. In this first installation it was decided to keep the speed of revolution of the wheel relatively small, and to make its diameter correspondingly large, in order to minimise practical difficulties which might occur in carrying out the experiments. The following particulars for the gyroscope will be of interest:—

Outside diameter of fly-wheel	1 metre.
Weight of the fly-wheel (without spindle)	1,106 lbs.
Peripheral velocity per second	274·8 ft.
Number of revolutions per minute	1,000

* Read at the Spring Meetings of the Forty-eighth Session of the Institution of Naval Architects, March 22, 1907.

The fly-wheel was made of forged steel in one piece. The cast-iron casing containing the wheel is carried on two hollow horizontal trunnions, their axis lying athwartships. These trunnions have ball bearings. The steam supply and discharge take place through the trunnions in the same manner as in an oscillating marine engine. The lower end of the spindle of the fly-wheel is carried on ball bearings, and there is forced lubrication to both upper and lower bearings. At the upper end of the spindle a centrifugal regulator is fitted, by means of which the steam supply is cut off if the revolutions per minute exceed 1,600. In addition there is an appliance by which a bell is rung after every 10 revolutions of the fly-wheel, in order that the engineer may readily check the rate of revolution.

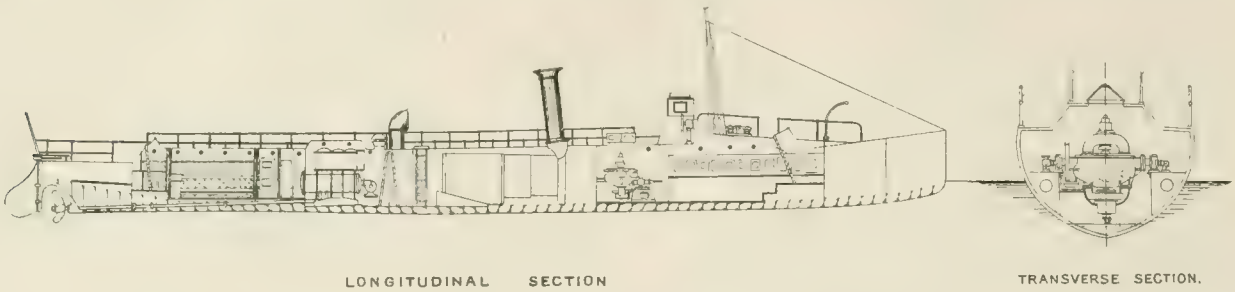


Fig. 1. S.S. "Seebar."

The common centre of gravity of the gyroscopic apparatus —fly-wheel and casing—is arranged to lie below the axis of the trunnions. When the vessel is at rest, in an upright position, the spindle of the fly-wheel will be vertical. When the vessel is set rolling the spindle of the fly-wheel is free to become inclined to the vertical in a fore-and-aft direction. As rolling proceeds the gyroscopic effect of the fly-wheel produces a practically horizontal position as the vessel performs vertical heaving oscillations; but the gyroscope meantime may be oscillating violently to and fro in the longitudinal sense, and the observer watching it may have the impression that the vessel herself is moving.

It will be understood that great importance attaches to the existence of efficient arrangements for controlling and "braking" the movements of the gyroscope on its trunnions, and the rotary movement of the fly-wheel. In the *See-bar* this matter has been carefully studied, and experiment has shown that the brake-arrangements are thoroughly efficient. The details are shown in Fig. 2, and require only brief explanation. A simple band-brake is fitted on the port side, and is worked from the deck above, in order to control the swinging motion of the apparatus on the trunnions or to hold it at rest. In addition there is a socket fixed on each side of the gyroscope casing below the fly-wheel, which carries a hydraulic brake cylinder, the piston rod lying fore and aft in the vessel. The braking power is regulated by a valve workable in the gyroscope compartment, and from the deck. This hydraulic brake answered its purpose well,

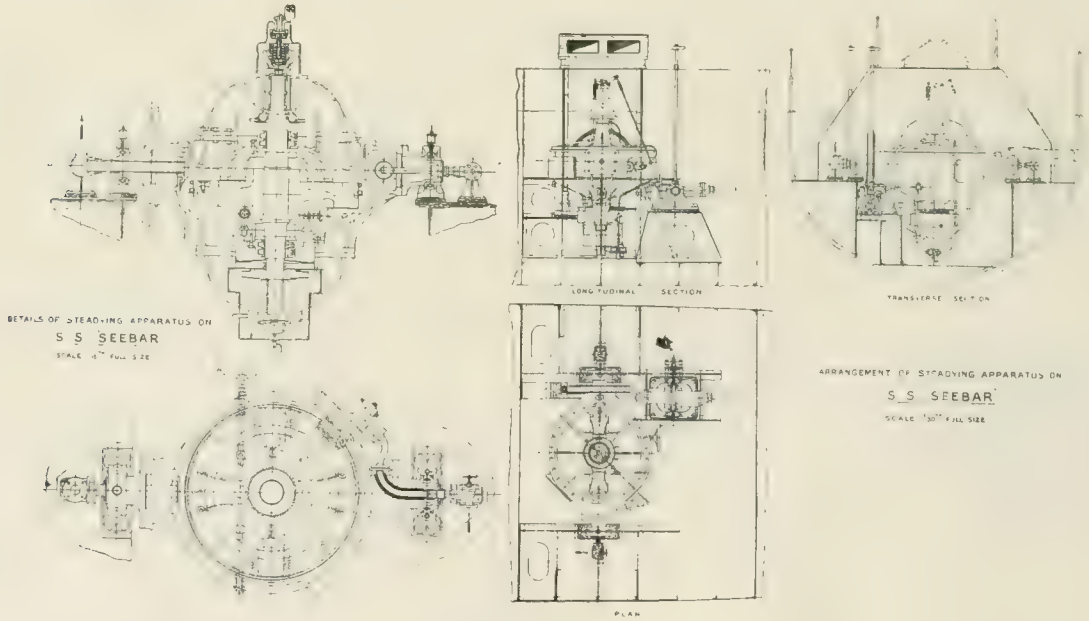


Fig 2.

ongitudinal oscillations of the apparatus. The period of these oscillations depends, of course, upon the distance of the centre of gravity of the whole apparatus below the axis of the trunnions, and upon the moment of inertia of the apparatus about that axis. The amplitude of oscillation of the gyroscope depends upon many and varying conditions, amongst which the period of oscillation and its ratio to the period of rolling of the vessel are important. It is most interesting to watch the movements of the gyroscope when it has been set free and is exercising a steadying effect upon the vessel. The observer may be standing upon a deck that maintains

but in electrically driven gyroscopes a different design would be adopted, involving less space and weight.

When the apparatus was used in experiments at sea the fly-wheel was set running while the casing was held fast by the friction brake in its central vertical position, and the revolutions were brought up to 1,600 per minute. Observations were made at first with the casing fixed; in which condition, of course, the gyroscope had no effect on the rolling motion. After a sufficiently long period of observation in this condition had elapsed to enable the "phases" of rolling to be determined, the friction-band was loosened,

the casing began to oscillate on its athwartship trunnions, and the gyroscopic action came into play. Another series of observations of rolling was then made, and the steadying effect of the gyroscope was ascertained by comparing the two series of observations.

To be continued.

OBITUARIES.

Sir Henry Montague Hozier.—It is with extreme regret that we have to record the death of Col. Sir Henry Montague Hozier, K.C.B., who had recently occupied the important and responsible position of the Secretary of Lloyd's for more than thirty years. It will be remembered that he only resigned this position in October last, and it was conceded on all sides at the time that he had not only filled such position with great distinction for so long a period, but that as far as the Committee of Lloyd's were concerned, his achievements were looked upon with the highest appreciation. Sir Henry Hozier had an exceptionally varied and useful career. The son of a landed proprietor in Lanarkshire, he spent some of his early years on the Continent, where he acquired that knowledge and fluency in foreign languages which ever afterwards stood him in good stead. On his return to England, he went to Rugby and to the Edinburgh Academy and subsequently to the Royal Military Academy at Woolwich. He obtained his commission in the Royal Artillery and shortly afterwards was ordered to China, where he served in the China campaign and was present at the capture of the Taku Forts and actions near Tang Chow, receiving for his services a medal with two clasps. After the China war, he was transferred to the 2nd Life Guards as a lieutenant, and in 1861 passed into the Staff College at the head of the list and after two years passed out of it with the highest honours. In 1864, he took part in the campaign between Germany and Denmark and subsequently received an appointment to the topographical staff of the War Office. He served as war correspondent for the *Times* in the war between Prussia and Austria in 1866, and was afterwards appointed Secretary to the Commission on forming a Reserve for the Army and served as Assistant Boundary Commissioner under the Reform Act of 1867.

During the British expedition to Abyssinia, Sir Henry Hozier acted as Assistant Military Secretary to Lord Napier of Magdala, at that time being a lieutenant of the 3rd Dragoon Guards, but immediately afterwards he was promoted to a captaincy in the same regiment. In 1870, he was appointed controller at Aldershot with the honorary rank of lieutenant-colonel, but on the outbreak of the Franco-German war he was appointed Assistant Military attaché at the headquarters of the German Army, and received the Iron Cross from the Emperor. He was re-appointed to the War Office Staff on the conclusion of the war and in 1874 received the appointment of Secretary to Lloyd's. In 1876, he undertook the command of the 3rd Kent (Royal Arsenal) Artillery Volunteers. He was made a Companion of the Bath in 1897 and six years later was created a Knight Companion of the same order.

It was our pleasure to be intimately acquainted with Sir Henry Hozier, he was a man of exceptionally agreeable manners, he had the happy capacity of carrying on his work with great smoothness and regularity and it was clear to those with whom he came in contact that no difficulties appeared to ruffle his demeanour or interfere with his methods, and it has been fully recognised by those with whom Sir Henry has come in contact in connection with the important business transactions of the office that he held, that he was eminently suited to deal with the important interests dealt with by the Institution, which he has so faithfully served for so many years.

He had taken a journey to Central America and unfortunately was seized with fever and after twenty-four days' illness succumbed.

Sir Daniel Dixon.—The death of Sir Daniel Dixon, Bart., D.L., M.P., at the age of sixty-two took place with tragic suddenness on Sunday, 10th March, while he was on his way to attend morning service at Holywood Parish Church. Sir Daniel was the member for North Belfast, was seven times Lord Mayor of the city, and had been for the past seventeen years an active member of the Harbour Board, during the last three of which he held the responsible position of chairman. In addition to various other business interests, he was the sole partner of Messrs. Thos. Dixon & Sons, shipowners and timber merchants, and managers of the Lord Line. He was also a director of the Ulster Steamship Company, and of the Ulster Marine Insurance Co., Ltd., By his sudden removal from their midst, the citizens of Belfast have been robbed of one who worked strenuously for the advancement of the interests and prosperity of Ireland's greatest commercial centre. "Sir Dan," as he was affectionately called by everyone, young and old, rich and poor, was a man of sterling, upright character. He never went out of his way to court popular opinion, but did what he conceived to be his duty without fear or favour. He was looked upon, and rightly looked upon as "Belfast's Strong Man," and his place will be hard to fill. Sir Daniel was not one of those men whom a succession of honours spoils; he retained always the breezy, generous disposition that had endeared him to all with whom he came in contact.

John I. Thornycroft & Co., Limited, Chiswick. — An exceptionally large order for a motor installation has been placed with this firm consisting of a set of three of their well known D4 type engines, each engine developing 100 B.H.P. at about 750 revolutions. These will be installed in a very handsome yacht which is now being built in Sydney under the supervision of the architect, Mr. Walter Reeks, for Mr. S. Hordern, a prominent yachtsman of that city. The yacht will be 110 ft. in length, with a beam of 17 ft. 6 in., and of a very seaworthy type. The cabin accommodation is on a sumptuous scale, and very well thought out. The motors are arranged to drive triple Thornycroft propellers through reversing clutches. They will be started by compressed air supplied by a Thornycroft 6 B.H.P. (B-1) engine. This arrangement renders the whole plant as easily controllable as a steam engine, while the gain in space and in other obvious respects is immense. This type of Thornycroft motor is already in use by the Indian and other Government departments, and has also been most favourably reported on where it is in use commercially, as being very economical in fuel, easily controlled and seldom getting out of adjustment. As an indication of the manner in which China is progressing, and in contrast to the slow adoption of the motor for fishing purposes in this country, it is very interesting to record the receipt by Messrs. Thornycroft of Chiswick, of a large order for motor boats from Tientsin, to be used for fishery service. This order has been secured in the face of keen competition by American and other makers of motors and boats. It consists of eight launches, each 25 ft. long, fitted with Thornycroft 6 B.H.P. motor, reversing clutch and Thornycroft solid propeller. The boats will be built of mahogany and are a very seaworthy type suitable for use as yacht's tender, or along the coast, either for pleasure cruising or fishing. They are equipped with sails, so that with a fair wind the motor is not used. They follow very much the model of that most successful little 6 B.H.P. launch *Veradaise II.*, which was exhibited at Olympia.

Engineers-in-Charge in the Navy.—Sir William White, in the course of his remarks at the annual dinner of the Association of Engineers-in-charge, said that not the least of its advantages was the feeling of professional sympathy which existed among its members, and in times of stress and difficulty such sympathy was of the utmost value. Its educational side also was of the greatest service to the younger members. He referred to the position of engineers-in-charge in the Navy, and expressed his strong disagreement with the policy of promoting leading stokers to the charge of machinery in place of properly trained engineers. However excellent a man might be in charge of boilers and steam-generating plant, such work was entirely different from the handling of powerful machinery, which should only be entrusted to the care of those who had been brought up specially for such work. The wisdom of our ancestors showed this to be the true way, and a grave risk was being incurred in departing from it. He wished the Association every possible success. No doubt they would grow, and they might even be in the position of having branches in various parts of the country; but, however great the success they attained, it would not be beyond the wishes of their guests of that evening.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

THE events of most note during March in connection with shipbuilding on the Clyde were the launches of the cruisers *Indomitable* and the *Inflexible*, both sister ships of the *Invincible*, being built at Elswick. The Fairfield Company on the 16th successfully consigned the first-named to her native element amid the huzzas of a great concourse of spectators inside and out of the renowned shipbuilding works, in which so many important vessels for both the naval and mercantile marine have been brought into being; and the Clydebank firm of John Brown & Company were equally successful in sending off the *Inflexible* from the stocks of their well-known establishment on the 30th.

With the launch of these two magnificent vessels naval work on the stocks in Clyde shipyards is practically a minus quantity, the only remaining work being the two torpedo boat destroyers in the yard of Messrs. Wm. Denny & Bros., Dumbarton. Afloat, of course, there is the battleship *Agamemnon* at the Beardmore establishment, Dalmuir. In the matter of engineering work for naval ships building elsewhere there is an equally meagre amount on hand. The only item is the turbine machinery for the dockyard built battleship *Temeraire*, one of three vessels of the *Dreadnought* class, which is being made in the Fairfield works. Should, therefore, the curtailment, which it would appear is to be made in this year's building programme under the naval esitmates, be actually carried out, there will not be a single Government vessel on Clyde stocks by the time next year's programme is being allocated. The two—or, counting the *Agamemnon*, three—vessels which will then be fitting out will be in a very advanced state of completion, while the torpedo destroyers now under way at Dumbarton will also, if all goes as usual, be completed, if not in actual commission. This state of matters is causing disappointment in those Clyde yards which are fully equipped with heavy appliances mainly installed to undertake naval work. The Clydeside workmen also have come to regard a share of Admiralty favours as much their own right as it is that of the artizans of the Royal dockyards, whose representatives in Parliament keep effectively knocking at the door of the Admiralty for work and sustenance.

The Clyde district of the Amalgamated Society of Engineers recently applied to the North-west Engineering Trades Employers' Association for an advance of wages to the extent of 1s. per week on time rates and 2½ per cent. on piece rates. The application will shortly be considered at a "local" conference, but not until after the sitting of the special Conference in London on the terms of settlement, and that of the central conference, which is also pending, for the consideration of questions affecting other districts. In the meantime, in accordance with the terms of settlement, work has been proceeding on the old conditions. A conference between representatives of the Clyde Shipbuilders' Association and the Executive Council of the Boilermakers' Society will be held on April 4th, when the question of a 5 per cent. advance on the wages of the boilermakers in the Clyde district will be discussed. On October 1st last year, it will be remembered, the Clyde shipyard members of the Boilermakers' Society struck work in order to enforce a demand for an advance of 5 per cent. This advance they were refused, and after a strike of seven weeks they resumed work on the understanding that the question of wages would come up again about the end of March. The conference has been arranged at the request of the men's representatives.

Messrs. Mackie & Thomson, of Govan Shipbuilding Yard, who inform us that the notices which have appeared regarding their proposed removal to Irvine is altogether premature, have recently begun work on a contract for as many as 18 steam drifters for North of Scotland owners. These vessels are small, but can only be laid down three or at most four on one line of berthing, and admit of a limited number of workers on each hull, so that the work will extend over the greater part of the summer. The business of the firm hitherto has consisted for most part of trawler building, of which they have produced a very large number, but of drifters they have only produced about half a dozen. The building of trawlers and drifters is still an increasing industry, and the Govan firm are assured of a continued and important share of the industry. On the 14th ult. the firm launched a trawler of 195 tons, built to the order of the Great Northern Steamship Fishing Company, Limited, Hull, being the last of an order for three trawlers for this company. She is, in fact, the fifty-ninth vessel built by the firm for the same owners. As in the case of most of these vessels produced by the Govan firm, engines will be supplied by Mr. W. V. V. Lidgerwood, Coatbridge.

Messrs. Fleming & Ferguson, Limited, Paisley, have received an order for a twin screw bucket dredger for carrying out improvements at the Port of Rio de Janeiro.

The Grangemouth and Greenock Dockyard Company have contracted to build a steamer of about 250 ft. in length for foreign owners. The new vessel is being laid down in the firm's Greenock yard.

Messrs. Ramage & Ferguson, Limited, Leith, have received an order for an awning deck steamer of about 1000 tons for trading in the Far East. They have also received an order from Mr. Joseph Pulitzer, of New York, to build a twin-screw steam yacht of 1500 tons Y.M. to the designs of Messrs. G. L. Watson & Company, Glasgow.

The manipulation of steel in the cold state—that is without furnacing—for the structural features of ships has made great progress within the last few years, and many things point to its further development, the saving of time and labour in this direction being, of course, immense. Larger bending machines of a type designed by Mr. Nicol S. Arthur, engineer, Glasgow—whose ship frame bevelling machine is so well known in all important shipyards—are now being adopted in a number of the largest shipbuilding establishments to deal with the bending or straightening of beams and other bars without being heated. At the Beardmore Works, Dalmuir, one of these bending machines has been installed for considerably over a year, and accomplished highly important work in bending and straightening the beams and other bars entering into the structure of the battleship *Agamemnon*. With a similar machine elsewhere ship frames themselves have been curved in the cold state to form the round of bilge. The makers of this type of machine, by which greater economy of labour and time is secured, are Messrs. Smith Bros. & Company, Limited, Kinning Park, Glasgow, and they are at the present time manufacturing one of these machines of the very largest calibre for Messrs. Vickers, Sons & Maxim, Barrow-in-Furness.

George Russell & Company, Motherwell, who, a few years ago constructed the *Hercules* floating crane of 50 tons capacity, which is now doing excellent service for its owners, the Mersey Dock Board, have recently concluded a further installation at Liverpool, of harbour cranes of their manufacture. Six new electric travelling cranes having 50 ft. jibs, which had been built on the ground level at King's Dock, complete in every respect with chains, ropes and all gearing ready for work, were lifted, each in one lift, on to the rails on top of the new lofty two-storey sheds. The 50-ton floating crane *Hercules* was used, and although the weather was very boisterous, the cranes were safely placed.

Messrs. McAlpine & Company, Limited, is the new firm name under which the business of lead pipe bend and trap manufacture, hitherto carried on by Messrs. Egerton and Company, Limited, at Thistle Works, Campbell Street, Govan, will henceforth be conducted. Mr. Jas. B. McAlpine, who has hitherto managed the business both commercially and practically at Govan, is the managing director of the new concern, and under his skilful and enterprising conduct the company will no doubt find enlarged demands for the specialities they produce by means of the very special machinery and plant involved in their manufacture. The distinctive advantages of the bends manufactured by this company's process is that in the hydraulic drawn bends the material is of uniform thickness and strength at the bends, no matter how sharp these may be, a result which can never be attained in the bends made by hand in the usual way. The ductility of these solid drawn bends is greatly superior to hand-made work, as the bends can be turned over and stretched for

flanging without tearing. They have been adopted in a number of the most important new steamships, amongst others the Allan Line turbine steamer, *Virginian*. The makers stock the usual right angle bends, etc., from 1¼ in. to 7 in. diameter, while, of course, in the matter of weight they provide bends from 10 lbs. to 168 lbs. per yard as required, and according to diameter of pipe. The cost of these specialities will be found to compare favourably—especially when consideration is given to their efficiency and lasting qualities—with the cost of the hand-made articles, while owing to the full stock held by the makers a very appreciable saving in time can be made when executing any urgent repair jobs.

THE TYNE.

(From our Own Correspondent.)

Shipbuilding.—A report is in circulation to the effect that Messrs. Armstrong, Whitworth & Co. have booked an order for three battleships, which are to be laid down at the Elswick yard, where important extensions, including the formation of one or two new building berths, have been in progress for some time. Should the report, which is at present unauthenticated, prove to be correct, the Elswick establishment will have an immunity from slackness for another year or two, as there are already several very important uncompleted contracts in hand. It is stated that certain Continental firms are inviting from English builders tenders for steamers of superior equipment, and an expectation exists which we hope may not prove unfounded, that some of this work will be secured by firms on the Tyne. Messrs. Swan, Hunter & Wigham Richardson launched last month two steamers which, though of small size, were of a more than ordinarily interesting description, being of the nature of a new departure in their respective types. Both the vessels were ordered by firms in New Zealand, which important colony has been for some time past a good customer of the great Wallsend establishment.

Messrs. Wood, Skinner & Co., who recently supplied two handsomely designed vessels to a leading shipowner of Copenhagen, have still some good contracts in hand, and are, it is stated, in negotiation for others. Messrs. Hawthorne, Leslie & Co. have a vessel in an advanced stage on the stocks, and two or three others in early stages, whilst in the repairing department the activity noted in previous reports is well maintained. Messrs. Stephenson's yard, adjoining, is also well supplied with new work, and the large graving dock connected with this establishment has been pretty constantly occupied with vessels requiring repairs, since the opening of the year. The Palmer Company's shipbuilding department, the productive facilities of which are now second to none, is well provided with work, and the state of business in the steel works and also in the forging and engineering shops, continues to be satisfactory. At the Northumberland Shipbuilding Company's yard, from which two or three exceptionally large vessels have been turned out this year, there are still several big boats on the stocks, one or two of which have only been put down lately. The Tyne Shipbuilding Company and Messrs. Readhead, both maintain the customary activity in their yards, and the Smiths' Dock Company have as much repair work in hand as they can deal with. Messrs. Brigham & Cowan, who have enjoyed very marked success since they opened their new graving dock at the mouth of the river, are still very busy in all departments of their works.

Engineering.—Since the refusal of the employers to grant the request for an advance of wages, put forward on behalf of the operatives in the engineering shops, nothing further has been heard of the matter, and the natural inference is that it will be allowed to lapse. If the demand had been persisted in, a bitter struggle for supremacy would have taken place between the masters and the engineers' society, and this would have been fatal to the latter, the masters' resources being superior to all the combined aids that might be brought to bear in favour of the men. It may be accepted as a truism that the masters will not need to be asked twice for an advance of wages when the condition of trade is good enough to permit of it, as they know what the costliness of an industrial struggle is, and they will always be anxious to avoid such. They will accordingly only resist claims that cannot be conceded without endangering trade, which result would, of course, be prejudicial to all.

The principal marine engine works still maintain a fair show of briskness, but the difficulty of securing new orders at remunerative prices is more keenly felt than ever, and it is quite certain that the new work that has recently been booked is not at all equal in quantity to what has been completed and delivered in the time. Messrs. H. Watson and Sons, of the High Bridge Works, Walker Gate, continue to have a good demand for their leading specialities, including their patent feed water filter, their ballast pump and evaporator, all of which are among the most popular accessories now being fitted in steam ships. Messrs. Donkin and Co., of the St. Andrew's Works, in the same locality, continue to secure a good proportion of the orders that come upon the market, for steam steering gears and ships' telegraphs. The manufacturing resources of the firm are now so extensive as to enable the firm to meet customers' requirements with quite exceptional promptitude. The electrical works of Messrs. J. H. Holmes & Co. are kept steadily going, the contracts in hand being mostly for shiplighting, in which branch of electrical engineering the firm have achieved a very high reputation. They were, we believe, amongst the very first who gave special attention to this branch of work, and they have not failed to profit by the experience gained in the early days of ship lighting by electricity.

Messrs. Noble & Lund, of the Northern Machine Tool Works, Felling, are very busy in the manufacture of their various specialities, consisting of band saws for cutting iron or steel cold, lathes, drilling machines, etc. The Works have been greatly extended within the past few years, and it looks as if further extensions will become necessary, so steadily are the products of the firm gaining ground in popular estimation. There are few engineering firms of note in the country that have not some of the Felling machines in operation, and the firm's foreign connection is daily being extended. Messrs. Hawthorn, Leslie & Co.'s locomotive works, Forth Bank, are, we understand, well supplied with orders, many of these having been received from sources outside the United Kingdom. The works of Messrs. Scott & Mountain, Gateshead, are kept very satisfactorily employed, electrical pumping and ventilating engines for collieries being the principal products in this case. Engineering works at Tyne Dock are, for the most part, doing well, and the packing works of Messrs. Newton and Nicholson are as busy as possible.

Messrs. Crosier Stephens & Co., of No. 2, Collingwood Street, Newcastle, have introduced a new speciality named the "Polygon" Patent Shaper for Metals. This is bound to prove a most useful appliance in all engineering shops, as it is very compact and in many cases will enable the work of shaping to be done effectively without the use of either chisel or file. The design of the "Polygon" is bold and symmetrical in outline, having ample metal throughout to impart power and accuracy as a tool, and to confer great rigidity under working strains. It would be particularly useful on steamships, and we expect to see it fitted in many vessels, ere long.

Messrs. Holzapfel's works, Heworth Shore, in which their well-known paint compositions for ships are manufactured, are kept fully going in all departments, and the weekly output continues to increase steadily. The St. John's Leather Works (Messrs. Geo. Angus & Co.'s) are kept very busy in the manufacture of machine belting and other special products, and in the indiarubber department, where marine engine packings constitute a speciality, the customary activity is well maintained. Steel works at Newburn, Consett, and Jarrow are kept going briskly, and in each case the weekly output is above the average. Local ironworks are also doing fairly well; but no improvement is seen in the state of business at the forges.

THE WEAR.

(From our Own Correspondent.)

Shipbuilding.—The seventeenth annual meeting of Messrs. Doxfords' Company was held on the 11th inst., and the report of the year's working was presented. This showed that a profit of £36,877 12s. 8d. had been realized after transferring £20,000 to reserve account, which has now reached the large figure of £120,000. The amount of work

in hand is stated to be "satisfactory," which statement, coming as it does from the chairman and his co-directors, must be accepted in its completely literal sense. A report is current that Messrs. John Priestman & Co. have booked an order for two large steamers to be built on foreign account, but, as yet, the report has not been substantiated. At the yard of Sir James Laing & Sons, great activity is maintained, there being no less than five vessels, all of which are of a superior type, in various stages of progress on the stocks. There are also two or three vessels in the water being fitted out. Messrs. Robert Thompson & Sons are completing at their Bridge Dockyard an extensive repair to the s.s. *Tregenna*, which had been sunk in the river Thames through collision with another vessel. The firm are also doing some repairs to the large dredger *Wear*, including the fitting of a new steel deck. The firm are understood to have other work coming, and are likely to be kept pretty fully engaged for several weeks to come. Messrs. Austin have had on their pontoon during the greater part of the present month the locally owned steamer *Magnus Mail*, on which extensive repairs had to be carried out. They have had several other repair contracts to deal with, and are still very busy in that department of their works. Messrs. John Crown & Sons have launched a vessel lately and have placed the keel for another in the vacated berth, thus keeping the three berths occupied. This firm have also had a good run of repair work during the past few weeks. Messrs. Blumer are said to have secured some additional work, and the two yards at the South Dock continue to have their berths occupied.

Engineering.—The principal marine engineering establishments continue to keep the machinery in full operation, and in the smaller works a modified activity is still observable. Foundries and ironworks are still pretty busy, but forges have but little work in hand. The handsome new building that has been erected for the Wear Commissioners in John Street, Sunderland, was formally opened by Mr. Jenneson Taylor, the chairman of the Commission, on the 14th inst. At this function all the members of the Commission were present, as well as the principal officials, and some interesting speeches were delivered. John Street is the real business centre of Sunderland, and it will be an immense convenience to the members of the Commission to have their offices located there.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

THE latest Manchester Ship Canal Bill has been allowed to pass the Lords Committee. It provides for pumping more water into the Canal than is at present provided for; the getting of coal under a certain section; and the purchase of land on which to deposit the dredgings from the Canal.

The steady growth of the Ship Canal is stimulating inquiry as to whether the time is not ripe for marine engineers to make their presence desirable on the waterway. One or two allusions have been made to the subject in assemblies more or less connected with local engineering and with the Canal. There is room for a shipbuilder's wharf. Some movement in this direction is expected in the not distant future.

The Manchester Corporation during the month have been endeavouring to organise direct cattle shipments to this city. Early in the month, Councillor Hornby and Mr. W. J. Wade, manager of the Foreign Animals Wharf, went on a visit to the United States and Canada in order to interview some of the leading exporters and shippers. It may be mentioned that the lairages at the Old Trafford Wharf are connected with branch lines to the main trunk railways running to every part of the country.

The timber trade continues steady, imports moderate and prices well maintained. The consumption is also considered to have continued satisfactory. During January and February there were imported 40,000 cubic feet of sawn pitch pine, 25,000 pitchpine planks; 1,000 birch planks; 3,730 spruce deals (standards); 140 pine deals; 1,070 Baltic deals, and 1,420 Baltic flooring. The trade in sawn pitchpine is increasing.

The *Mersey* and *Irwell* Joint Committee, the object of which is to make those rivers flow with water which shall be inoffensive to the Manchester Ship Canal, have now been labouring for many years to check the inflowing of foul water from manufactories, towns and villages spread along their banks. The task is evidently more vast than that of Hercules. At the last meeting of the committee, 40 samples of effluents were submitted by Mr. Frank Scudder, their chemical adviser. Of these, 22 were pronounced to be good, seven fair, three unsatisfactory and eight bad. Of course, the result was that offending parties were ordered to be written to for an explanation. It is a sad reflection on our boasted civilization that rivers and streams, once pure, and the delight of the angler, should, through the cry of "don't check our trade," have been allowed to become mere open sewers and a positive danger to the local residents.

Cotton imports have been more satisfactory so far as the present year has advanced than last year. Up to the present date, we have received about 400,000 bales, 100,000 in excess of the amount landed at the same time last year. From Egypt we have received about 200,000 bales, 9,000 more than the previous record.

It has yet to be demonstrated, but there is a rumour current in Manchester that a new industry is about to be established in Trafford Park on the borders of the Ship Canal, which will produce something to rid us of the smoke nuisance both from factory shafts and cottage chimney pots, and that a saving of something like 35 per cent, will be effected in our coal bills.

The popularity of the Isle of Man as a pleasure resort is increasing to a degree which must be considered extraordinary. Last year, more than 100,000 passengers were taken to and from the island from English and Scotch ports than in 1905. A notable increase has been observable in week-end excursionists. By next year, the Isle of Man Steam Packet Co. hope to have a new turbine steamer on their service as big and as fast as the *Viking*. So successful was the last season that the existing *Viking* has been fully paid for without anything being added to the share capital of the Company. If the coming season proves as good as the last, the Company hope to place an order for a twin-screw steamer for the winter service. A sum of over £29,000 has been applied to the depreciation fund and a dividend of 6¼ per cent. declared.

Efforts are being made in Brisbane and other places in Australia to develop the green fruit trade with Manchester *via* the Ship Canal. Foreign apples hitherto have realized from 3d. to 1s. 6d. per barrel more than at Liverpool. The growth of the green fruit trade to Manchester Docks since the opening of the Ship Canal has, with one or two exceptions, increased every year. In 1894, the imports totalled 17,723 tons; last year, 1906, the amount was 112,000 tons. Compared with the cost of carriage from London, retailers in Birmingham, Bolton, Bradford, Leeds and Rochdale save from 7s. 2d. at Birmingham to 28s. 10d. at Rochdale.

A scheme has been suggested for the construction of a tunnel under the Ribble at a cost of £600,000. The tunnel would be two miles in length, extending from Warton Bank to Hesketh Bank and would save a large sum annually in railway fares. The tunnel would form part of a direct line from Wigan to Blackpool.

The coal trade of the county shows a little weakness in house qualities, but remains strong in all other sections at the increased rates previously recorded. Gas coal and cannel are from 2s. 6d. to 3s. per ton dearer than last year's contracts. There is more demand for steam coal than can well be supplied and the increase in shipping coal continues. Last year the output of coal was 236,111,150 tons, an increase of 15,000,000 tons on 1905. The quantity exported reached 57,792,000 tons, and to that has to be added 17,396,000 tons for bunkering. Average quotations at the pit's mouth are as follows: best house coal, 14s. 6d. to 15s. 6d.; secondary, 13s. 6d. to 14s. 6d.; common, 10s. 6d. to 12s. 6d.; burgy, 8s. 10d. to 9s. 6d.; best slack, 8s. to 9s.; low qualities and medium, 6s. 9d. to 7s. 9d.; shipping coal, 12s. to 13s. f.o.b. at Gareton; furnace coke, 17s. to 24s.

The Lancashire iron trade has shown a weakness during the month in every kind of pig iron and prices have fallen several shillings per ton. It is not expected by many that this fall will be of long duration, yet some pessimists prophesy still further reductions by the end of June. Manufactured iron has not followed suit. Bars are a trifle easier, but there is no quotable change in plates for steam boilers, girders, hoops, channels, tees, angles, etc. Copper and tin have wavered and fallen during the last fortnight or three weeks, but it is likely enough that the position may be quite reversed

when these lines appear. It is not safe to give quotations that might be misleading. Hematites have remained fairly steady.

Our local textile machinists and general engineers continue well employed. The British Westinghouse Electric and Manufacturing Co. are progressing with the manufacture of turbines and gas engines. Many turbines are being erected, not only for English users, but for Russia, Japan, France and Australia. One turbo-generator of 40,000 kw. capacity is for the Czar for his Tsarskoe Selo Palace. Gas engines are being despatched to various home and foreign centres. Electric cars are likewise being turned out in considerable numbers.

THAMES.

(*From our Own Correspondent.*)

IN our survey of the month as far as it concerns the river, we note the continued agitation as regards the future of the port, which remains in about the same position. The Dock Co.'s proposals are strenuously discussed. It is said that if any more big steamers came to the river they would have to be refused, as Tilbury is full where such ships can be berthed. Since 1899, though there has been an increase of 3,000,000 tons to the port, there has been no increase of accommodation. The Company say the fear of adverse legislation has prevented their using the powers they already possess, but if the Bill they propose passes, they will deal with extensions, not only at the Royal Albert, but also at Tilbury, the scheme for which provides for three miles of new quays and a new lock and graving dock, each 900 ft. long, 100 ft. wide and 45 ft. deep. Opposition comes from various quarters to the proposals, but chiefly, perhaps, from traders, who have been accustomed to have goods hitherto brought in free. The Company says 80 per cent of goods now brought in is landed into lighters and goes free. Shipping companies support the proposals, as dues are to be reduced to 1s. a ton from 1s. 6d. now charged. Wharfingers doing a similar business to the Dock Company are in favour for obvious reasons. A strong feature, which appears to support the Company's agreement, is that if the Bill is passed they can get to work on the extensions at once, whereas with a new port authority created it would be some years before any progress could be made at all.

The report of the Surrey Commercial Dock Co. for the past year shows an increase of 15,500 tons over 1905, the conflicts between the dock companies being said to be answerable for some of the reduction in the wood imports. Regarding the general question of the docks, it is significant that this Company favours the London & India Co.'s bill to be brought forward and to which we have referred.

The Thames Conservancy are making good progress with the dredging of the river below Gravesend. The most powerful vessel engaged on this work can lift 4,600 cubic yards of material in a working day of 24 hours. The channel when complete will be 1,000 ft. wide and 30 ft. deep at low water Spring tides right up to Gravesend. The annual refit of the Conservancy vessels has just been given out to firms on the river, new work comprising a pontoon for carrying a crane and grabs.

One of the proposals before Parliament is to construct a new Thames tunnel below the river at Purfleet and connect the South-Eastern and London, Tilbury and Southend railways.

The Royal Commission on shipping rings has been holding sittings in the City and the question of rebates came up for discussion, but no remedy appears to be suggested, the opinion being freely expressed that freights are too high.

The question of the proposed new Australian fleet of steamers has been a prominent one, there being a withdrawal by one of the builders comprising the syndicate from the matter altogether and the failure of the syndicate to get their debentures taken up in England. Motives have been freely imputed of animosity on this side to the scheme, but the retort is that the venture is not likely to be a successful one. There is mention of the Australian Government having to guarantee the new debentures, shipowners concerned here are therefore a little curious to note the next steps to be taken on the other side.

The Channel Ferry Scheme has come before the public again by the holding of its statutory meeting, and the chairman emphasizes the point that the proposals have not the same dangers that may be ascribed to a tunnel under the straits. The present company is concerned only with the preliminaries and these are in progress at the present time.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—A very much better tone characterizes the shipbuilding trade of Barrow this month, as some important new business has been transacted which will introduce a renewal of activity in all departments. For some time past the work in hand in the shipbuilding department of the works of Vickers, Sons & Maxim has been limited, and there was less employment for the men than has been the fact ever since the present owners of the yard took it over from the Naval Construction and Armaments Company. In the first place the order booked some time ago for the Brazilian battleship, and the work in connection with which was stopped owing to a change in design, has now been ratified in a new form. The vessel will be much larger than was originally intended, and will in fact, be even larger than the British *Dreadnought*. She will have a displacement of over 19,000 tons, a length of 510 feet and a beam no less than 84 ft. She will thus be the largest battleship ever built. She is one of three being built in England for the Brazilian Government, and the order for the turbines of all these vessels has been placed with the Vickers' firm. The vessels will be mounted with ten 12-in. guns, and other guns of smaller calibre, and they will be armoured much more strongly than any vessels yet designed. The decision of the Brazilian Government to build such enormous up-to-date warships is looked upon as a bid for power in the South Pacific, and the effect it is having is shown by the desire of Chili, Argentina and Peru to strengthen their navies in mutual self-protection. It is therefore quite possible before long there will be a very brisk time in the building of warships for South American Powers. There will be another effect of the new policy of Brazil. It will lead, as it is already leading, all first-class Powers to the immediate consideration of the ways and means of bringing into existence war vessels of enormous size, great fighting power, and equipped with all the facilities which advanced naval science based on experience and natural evolution has shown to be essential, if those countries which need protection do not care to lose the power they have. A still further consideration is opened out by this new departure in the building of such big ships fitted with such terrible devastating power, and that is that it will render obsolete in the course of a few years vessels of war which may fairly claim to be our pride to-day. Naval constructors are, therefore, looking forward to a very busy time in the early future, and especially so as Great Britain will find the necessity, having the biggest Navy, to make more progress in this work of new construction than any other Power. Furthermore, from a British shipbuilder's point of view, there is the certainty that much of the new tonnage required by foreign Powers will be placed with them, as being better equipped for the work, and having within themselves the resources which build up all the departments of an up-to-date battleship. The work of building the new battleship for Brazil at Barrow will be pushed forward with all celerity, as not only is the South African Republic anxious to have delivery of the vessel, but the builders know her place on the stocks will soon be required for other ships of equal size and importance.

During the month the Vickers' Company have booked the order for a Mexican transport steamer which is said to be the forerunner of a new Mexican Navy. They have also secured the order for a large and powerful twin screw tug boat for the Furness Railway Company, and also a 500 ton steam barge for the same owners, and lastly, they have secured an order from the London and North-Western Railway Company to build two twin screw steamers for the Holyhead and Dublin service. These vessels will be about 300 ft. long and will have a speed of about 16 knots. The Vickers' firm have, therefore, now in hand a Brazilian battleship, an Indian survey steamer, a Mexican transport steamer, a tug

boat, a barge and two Channel steamers in addition to several submarines for the British Government. Other orders are expected, and it is hoped before long some important heavy tonnage will be booked, as the yard at Barrow is better equipped for this class of work than for small vessels. Indeed, the Barrow yard has been laid out at a very considerable cost specially for heavy war vessels, and yet the attention devoted to submarine work has introduced quite the opposite feature of construction. It is confidently expected that the order for most of the submarines included in this year's programme of British naval construction will come to Barrow. The outlook at Barrow therefore shows a vast improvement on the position a month or two ago.

It has been decided to build a new engineering shop in connection with the shipbuilding department of Vickers' works, as the present one is too small, and the site it occupies is required for new offices for the staff This new shop will embrace not only a large engineering shed, but a new smithy and forge and a new frame bending and angle bending shop. The need of new offices has been demonstrated for some time and the Vickers' Company, in their annual report this year, say they have put money on one side out of profits to provide new offices, not only at Sheffield but at Barrow. The Barrow offices will cost from £60,000 to £70,000.

The cause of the accident to the new 150-ton electric crane erected by a German firm on the Buccleuch Dock side at Barrow has been investigated by the engineers, who report that it will be necessary to increase the strength of the struts or bracings of the tower which carries the crane, and also to increase the strength of the counter-balancing jib which fell. The crane has to carry 150 tons, and will be tested before handed over to the company with a load of about 200 tons.

The work of widening the Buccleuch Dock passage way at Barrow from 80 ft. to 100 ft. is proceeding very satisfactorily in the hands of Sir John Aird & Co., the contractors, and it seems highly probable that this very necessary undertaking will be completed before the end of October.

There is very great activity in the engineering department of Vickers, Sons & Maxim's works at Barrow, and this is being imparted to the iron and steel foundries, boiler shops and into a large number of other departments which form part of the full equipment of this very complete and comprehensive department of Vickers' operations. There are indications that very great briskness will prevail in this branch for two or three years to come at least.

West Cumberland.—There is remarkable steadiness in the shipbuilding trade at Workington and Maryport, and orders seem to come to hand as freely as possible, as the work in progress from time to time is finished. At the end of February Messrs. R. Williamson & Son launched the steamer *Volpone*, built for Messrs. Rogers & Bright, of Liverpool. She is of the highest class at Lloyd's, and has a length of 163 ft. 9 in., breadth 26 ft. 6 in., depth moulded 13 ft. 4 in. She is designed to carry 720 tons. She will have triple expansion engines. The firm is busy with other steamers of a similar pattern. At Maryport the yard is fairly busy, and there is a good outlook in all departments.

Shipbuilding Material.—An improvement is noted in the demand for all classes of shipbuilding material, and the mills at Barrow are now in full operation. Prices are a shade easier, heavy plates being at £7 10s. per ton net cash. Increased activity is reported at the steel foundries, where heavy castings are made for ship and engineering construction.

Hematites.—The hematite iron trade is somewhat easier owing to the depreciation of warrant iron prices, but the general outlook of the trade is good. Makers quote 79s. for mixed Bessemer Nos. net f.o.b., and warrant sellers are at 72s. 3d. net cash. The difference is too great to ensure much business being done at the moment. Stocks are down at 67,188 tons.

Shipping.—Shipping keeps very busy. The exports of iron and steel this year have reached 190,279 tons, showing an increase on the corresponding period of last year of 27,213 tons.

Civil and Mechanical Engineers' Society.—At the meeting to be held on April 4th, a paper will be read on "Steam Traps," by Mr. Gordon Stewart, G.I.Mech. E.

BELFAST.

(*From our Own Correspondent.*)

FURTHER orders for high-class tonnage have been booked by the Belfast shipbuilders within the past few weeks, and in the case of every vessel launched for some time to come, there will be a fresh keel ready for laying down in the vacated berth. Trade has, in fact, rarely been brisker than it is at the present time.

Messrs. Harland & Wolff have close on 70,000 tons of shipping in hand for the Hamburg-American Line, and a considerable period will elapse before they have a vacant slip for the leviathan, which they have on order for this company. On the 2nd of March, they launched the fine twin-screw mail steamer *Avon* for the Royal Mail Steam Packet Company. The *Avon*, which has a length of 534 ft. 9 in., beam of 62 ft. 4 in., and a gross tonnage of about 11,000 tons, will be the largest vessel running to South America. The machinery consists of two sets of "balanced" quadruple-expansion engines. Lady Pirrie gracefully performed the naming ceremony. Good progress is being made with the fitting-out of the White Star liner *Adriatic*, which is expected to leave Belfast in April. The extensive repairs to the Orient Royal Mail liner *Oruba* are now nearly completed, and the vessel will shortly be ready for sea again. The news that Messrs. Harland & Wolff purpose establishing a ship and engine repairing yard at Southampton is scarcely a matter of surprise. With the approaching transfer of a portion of the White Star fleet to that port, and the fact that the largest German liners have frequently to be dry-docked there, it was inevitable that the Queen's Island firm should have a branch establishment on the spot. Southampton's gain will be Belfast's loss, for the new undertaking will, of course, mean that a considerable amount of graving-dock work will be done at the former port, which would otherwise have been carried out in Belfast.

Messrs. Workman, Clark & Company have booked an order for three Italian emigrant steamers. These vessels are to be 475 ft. long, with a speed of 15 knots, and accommodation will be provided for 2,000 passengers. They have also secured the contract for the construction of two more steamers for the Lloyd Brazileiro, making in all six steamers to be built by them for this concern. The first of these, the *Ceara*, was launched on the 16th of March. Messrs. Workman, Clark & Co. have built up a very considerable foreign connection, as evinced by the statement of Mr. C. E. Allan at the lunch subsequent to the launch of the *Ceara*, to the effect that his firm had business transactions with America, Germany, Holland, India, Japan and Italy. On the 12th of March, the new steamer, *Gando*, built and engined by this firm for the Elder, Dempster Line, had a very successful trial trip in Belfast Lough. The *Gando* is a vessel of 3,800 gross tonnage, and the machinery is of the triple-expansion type, steam being supplied by three boilers working under Howden's forced draught system. Mr. W. Boyd, who for many years past has been identified with the management of Messrs. Workman, Clark & Co.'s shipbuilding yards, has been appointed general manager of Messrs. Cammell, Laird and Co.'s Tranmere establishment.

The Belfast Harbour Commissioners' annual report is a very satisfactory one, the receipts for tonnage, quayage, dues and rates on goods showing an increase of £4,000 over the previous year. There was, however, a falling off in graving dock dues of over £3,000. This is, of course, accountable for by the subsidence at the Alexandra Graving Dock. The expenditure was £3,000 less than the year before. The surplus from the year was about £20,000, being about £3,000 more than the previous year.

Institute of Marine Engineers.—Friday, April 5th.—7-30, Annual Meeting. Monday, April 8th.—Lecture by Mr. T. F. Aukland (Companion), on "Self-Help." Monday, April 15th.—Paper by Mr. James Shirra (Member) on "Salinometry." Saturday, April 20th, 3 p.m.—Visit to the Testing Works of Messrs. D. Kirkaldy & Son, Southwark. Admission by ticket only, which may be had on application to the Institute. Monday, April 22nd.—Lecture by Mr. J. G. Hawthorn (Member) on "Fertility of Resource in the Engine Room."

JUNIOR ENGINEERS.

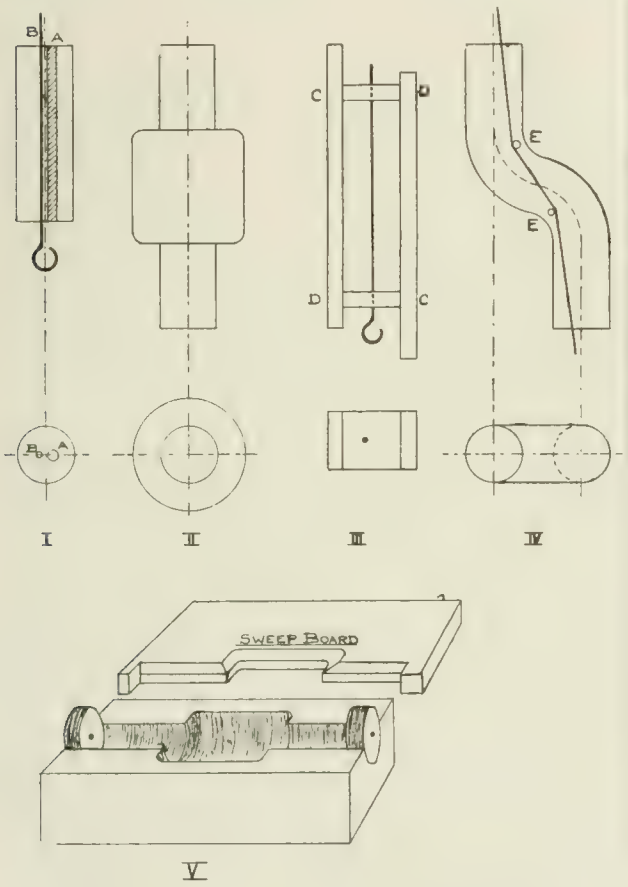
VII.*

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Moulding *(continued)*.

A FEW of the methods of core-making have already been referred to in connection with the sweeps and boxes, but the subject is sufficiently important to merit further treatment, for on the satisfactory construction of the cores quite as much as on the mould itself the success of a cast depends. Further, there is frequently more ingenuity required to devise how the internal structure of a casting



is to be built than for the outer form, especially so with large cylinder casings.

For plain cylindrical cores, Fig. I, the foundry has a series of boxes in stock from which any size of core may be obtained, these are of cast-iron made in halves, and for the shorter boxes jointed with dowel pins, the longer ones being provided with hinges.

The shorter cores, up to twelve inches long, are rammed from the ends with the box closed, above this length the box is opened back on its hinges and each half rammed separately, clay wash is brushed over the joint surfaces, the box smartly closed, the loose sand at the ends rammed in and the two parts thus cemented together form a solid core when dried.

While the core is in process of making, an iron rod of square or cylindrical section is inserted as at A, this rod stiffens the core, binds the sand together and prevents the core sagging under its own weight. Along with this rod a vent wire B is rammed in, and when the core is finished this wire is withdrawn, leaving a hole for the escape of gases produced by the hot metal. The dimensions of these rods vary according to the size of the core, for lengths of less than two or three inches no further support is required than that afforded by the print, above this length a core $\frac{1}{2}$" dia. will require merely a fine wire, while for 3" dia. $\frac{1}{4}$" rod is necessary. The vent wire varies from $\frac{1}{16}$" up to $\frac{1}{4}$" dia., and is fitted into a handle for convenience, or simply with a loop at one end.

Fig. II. illustrates a very common form of core which may be constructed in a variety of ways, depending on the dimensions of the material to be used, (1) a complete wooden box in halves dowelled together, (2) the three portions separately in standard boxes and joined together, (3) by turning up on a spindle, this will be considered later, (4) one half in a box, the other part by means of a sweep as shown at Fig. V., in perspective, the stopper pieces at the ends being drilled to admit the vent wire.

Fig. III. shows a rectangular core for which standard cast-iron boxes can frequently be kept, these, however, usually require wooden boxes due to variations of all three dimensions; the box is made of four strips screwed or nailed "cape and corner" at CC, and loosely sprigged at DD, the box being separated into two parts in removing the core, the ends being drilled for the vent wire.

Fig. IV. provides another form of venting, in this case the wire, tending to straighten under tension, would cut through the core on being withdrawn, to prevent this short wires are inserted at EE; the wire is in this instance frequently replaced by string, as being more flexible, and may either be removed as shown or burnt out in drying the core, the char remaining being blown through by means of bellows; the supporting irons are bent to the shape of the core, this type being either formed in a complete box, half box and scraper, or with sweep or striking board and scraper, as already dealt with in a previous article.

When the cores are made in part or wholly by the sweep method, the sand is pressed together and the scraper or sweep board worked over the rough form thus produced to remove the surplus, sand is then kneaded into the hollows and the board again applied, this being repeated till the true form is obtained, the rod and vent wire being put in during the process.

For large cores the rods are supplemented with iron grids, these are cast from a standard pattern, the required shape being obtained by stopping off the unnecessary portions of the grid mould with sand, and two or more may be bolted together where a large area is to be supported. These grids are easily broken up for removing from the casting and are thrown out as scrap to be remelted.

Heavy overhanging portions are tied up to the main body of the core by "lifters," these are simply iron rods having their ends bent over at right angles, one resting on a solid external support, the other end projecting into the sand, preventing it from falling away bodily by its own weight or the rush of metal. Any further support that is required, such as for thin projections or weak portions that may crack in drying, is completed by thrusting sprigs or wire nails into the sand at these points.

These rods and irons are also used in supporting the mould itself where necessary, in all cases being kept sufficiently far back from the metal to prevent injury to the casting.

* For Articles I. to VI., see last six issues.

Institute of Marine Engineers.—The annual meeting of members will be held at Romford Road, Stratford, on Friday, April 5th, at 7 p.m., when it is hoped there will be a full attendance to receive the annual reports, and transact the business in connection therewith. It is expected that at this meeting the Premier of New Zealand will present to Lord Pirrie, the retiring president, the gold emblem of New Zealand on behalf of the Australasian Institute of Marine Engineers. Messrs. James Mills (Union S.S. Co., of New Zealand), T. A. Peterkin (late of the New Zealand Railways), R. Wallace, R. Paterson (superintendents U.S.S. Co.), and A. R. Hislop (secretary Australasian Institute of Marine Engineers), are also expected to be present.

Calendar.—Under this heading, on page 297, last issue, our printers in error spelt the name of the firm with an *e*, but it was no doubt apparent to all that it should read The London Scaling Co.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Eugenie S. Embiricos.—On February 27th Messrs. Short Brothers, Limited, launched from their shipbuilding yard at Pallion, Sunderland, a handsomely modelled screw steamer built to the order of S. G. Embiricos, Esq., Cardiff. The dimensions of vessel are, length 387 feet, breadth 50 ft., depth moulded, 27 ft. 7 in., and she is designed to carry a large deadweight cargo on a moderate draught of water. She will take Lloyd's highest class and is built on the single deck principle with full shelter deck and deep framing. Ample water ballast is provided in the double bottom to enable the ship to make ballast voyages in safety. Comfortable accommodation is provided in deck houses on the shelter deck for captain, officers and engineers, and in forecastle for crew. Six large hatchways with nine derricks are fitted for the easy manipulation of cargo. To meet the requirements of the Cardiff Trimmers' Association the hatchways are trunked through the shelter deck. The machinery is by Messrs. J. Dickinson & Sons, Limited, Sunderland, and consists of engines having cylinders 25 in., 42 in., 70 in. diameter by 48 in. stroke, with two powerful boilers working at 180 lbs. pressure. During construction the hull and machinery have been under the supervision of Mr. H. J. Richards, of Cardiff. As the vessel left the ways she was gracefully christened *Eugenie S. Embiricos* by Miss Short, of Sea View, Sunderland.

Volpone.—On February 27th, the new steel screw steamer *Volpone* was launched from the yard of Messrs. R. Williamson & Son, Workington. The principal dimensions are—Length, 163 ft. 9 in.; breadth, 26 ft. 6 in.; depth moulded, 13 ft. 4 in., and is designed to carry 700 to 720 tons deadweight on Lloyd's freeboard. The vessel is built to the highest class at Lloyd's, and will be propelled by engines of the triple expansion type having cylinders 14 in., 22½ in., and 37 in. dia. with a stroke of 27 in., steam being supplied by a large cylindrical steel boiler 14 ft. dia. by 10 ft. long, working at a pressure of 170 lbs. The vessel has been built by the above builders to the order of Liverpool owners.

Badagri.—On February 28th there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay on Tyne, a steel screw steamer built to the order of Messrs. Elder Dempster & Co., of Liverpool, and of the following dimensions, *viz.*:—Length, 336 ft.; breadth, 46 ft.; depth moulded, 25 ft. 3 in., and to Class 100 A1 at Lloyd's on the shelter deck rule. This vessel has water ballast fitted on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including nine double cylindered steam winches, direct acting steam windlass, large donkey boiler, steam steering gear by John Lynn & Co., Ltd., and Hastie's screw gear aft. The engines, which are supplied by Messrs. John Dickinson & Sons, Ltd., of Sunderland, are of the triple expansion type, having cylinders 24 in., 40 in., and 66 in. by 45 in. stroke, and working at a pressure of 180 lbs. On leaving the ways, the vessel was named the *Badagri* by Mrs. Brunton, of Tynemouth.

Galavale.—On February 28th Messrs. William Doxford and Sons, Ltd., Sunderland, launched for Messrs. A. Crawford, Barr & Co., Glasgow, the turret steamer *Galavale*, designed for general trading. The principal dimensions are, length 366 ft., breadth 50 ft., moulded depth 26¼ ft. The deadweight of cargo and bunkers carried is 6600 tons on a draught of 21 ft. 9 in. The classification is with the British Corporation Registry. S. T. Taylor & Sons, of Newcastle-on-Tyne, are covering boilers, pipes, cylinders, etc., with their "Tynos" non-conducting material.

Ludworth.—On February 28th there was launched from the yard of the Blyth Shipbuilding Co., Ltd., a steel screw steamer built to the order of Sir Christopher Furness, M.P. Dimensions, 244 ft. 6 in. by 34 ft. 6 in. by 17 ft. 3½ in., with bridge and forecastle. Cargo cubic capacity, 93,727 feet, extra large hatches, steam steering gear, and direct steam windlass with quick warping ends, two steel masts. Cochran donkey boiler. Machinery by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland. Estimated speed about 10 knots loaded. The vessel is intended principally for the collier coasting trade of Messrs. Furness, Withy & Co., Ltd. On leaving the ways the vessel was gracefully christened *Ludworth* by Mrs. T. Harbottle, of Gosforth. Amongst those present were Mr. G. Moffitt, of the Blyth Shipbuilding Co., Ltd., Mr. and Mrs. T. Harbottle, Mr. and Mrs. W. Thirkell, Mr. and Mrs. R. J. Thompson, Mr. R. Bell, Mr. J. C. Gardner, etc., etc. Mr. G. Moffitt in proposing success to the steamer stated that this was one of several vessels his firm had built, and were building for the firm of Messrs. Furness, Withy & Co., Ltd. Those who had an opportunity of looking over the vessel would, as far as could be seen, have noticed that both the owners and builders had intended that she should make a remunerative return on the capital outlayed on her. After further remarks, Mr. Moffitt proposed success to the *Ludworth*, and as a memento marking the occasion, asked Mrs. Harbottle to accept a small present. Mr. R. J. Thompson, in responding for the owners, Messrs. Furness, Withy & Co., Ltd., said that he fully concurred with the remarks made by Mr. Moffitt as regards the money earning capabilities of the *Ludworth*. As time went on competition, especially in the shipowning line, seemed to become more and more keen, and it was only by working with the most up-to-date tools that shipowners could do any real good. He had noticed for some time past that there had seemed more disposition on the part of foreigners to enter into competition in what he might term their own trade, *i.e.*, the coasting trade, and, to be able to meet this competition successfully, it was necessary for them to own tonnage, in which were instituted all possible economies, and the latest innovations for the safe and rapid handling of cargoes. It was very noticeable lately that, in the coasting trade, the old tonnage was being more and more discarded, so much so that in the course of several years, he expected that none of the old tonnage built in the sixties and seventies would be seen engaged in the trade. After asking Mrs. Harbottle to accept from his firm a suitable memento of the occasion, Mr. Thompson proposed success to the builders, which was acknowledged by Mr. Moffitt. Mr. T. Harbottle returned thanks on behalf of his wife.

Norman.—On February 28th Messrs. Osbourne, Graham and Co. launched from their yard at Hylton, Sunderland, the steel screw steamer *Norman*, which they have specially constructed for Julius Christensen, Esq., of Aarhus, Denmark, to the order of Messrs. Furness, Withy & Co., Ltd. The vessel is of the following dimensions:—279 ft. by 40 ft. by 20 ft. 6 in. She is a single decker with poop, bridge and forecastle, built with deep bulb angle framing, and carries 3150 tons on a shallow draught, and has been built to take Lloyds' highest class. The accommodation for the officers has been fitted up in the poop, the cabins, saloon and mess-room being tastefully fitted out in hardwood. Engineers' accommodation is fitted around the engine and boiler casing, under the after end of the bridge. Vessel is equipped with the most modern appliances for economical working of cargo, the winches and steam windlass being supplied by Clarke, Chapman & Co., Ltd., of Gateshead, and steering gear by Lynn & Co., Ltd., of Sunderland. S. T. Taylor & Sons, of Newcastle-on-Tyne, are covering boilers, pipes, cylinders, etc., with their Tynos non-conducting material. During construction the hull and machinery has been under the superintendence of Messrs. Wallace and Co., of London and Glasgow, for the owners. As the vessel left the ways she was gracefully christened by Mrs. Wallace. After the launch the vessel was taken to Messrs. Geo. Clark, Ltd., Southwick Engine Works, Sunderland, to receive her engines, which have cylinders 20 in., 33 in., 54 in. by 36 in. stroke, with two large boilers.

Rapidan.—On February 28th Messrs. Furness, Withy and Co., Limited, Hartlepool, launched the finely modelled clipper steamer *Rapidan*, built to the order of Messrs. The Chesapeake & Ohio Steamship Co., Ltd., London, and is a duplicate of the s.s. *Roanoke*, at present being completed at the Middleton Shipyard, Hartlepool, for the same owners. The vessel is 385 feet in length, built on the shelter deck principle with a tier of beams, and has large measurement capacity. The hatches are large, allowing of bulky stowage in holds, special attention has been paid to all derricks and lifting gear, and the tween decks are available for the carrying of cattle. She has nine powerful steam winches, steam ash hoist, winch condenser, fresh water condenser,

cellular double bottom fore and aft, with large deep tank aft of engine-room, bulkhead and large after peak tank for water ballast; all the most up-to-date auxiliaries will be included in the vessel's outfit. Accommodation will be arranged on the shelter deck for the master and officers, and the crew will be berthed in the forecastle. Triple expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Limited, Hartlepool, the sizes of cylinders being 25 in., 40 in., 68 in. by 48 in. stroke, with three single ended boilers 14 ft. 6 in. by 11 ft. long, 180 lbs. working pressure per sq. inch, built to German Law requirements. The vessel has been built to British Corporation classification. The vessel was gracefully christened by Mrs. C. J. van Holzen.

Szterenyi and **Magyarorszag.**—On February 28th Messrs. William Gray & Company Limited launched at West Hartlepool the two handsome steel screw steamers *Szterenyi* and *Magyarorszag*, which they have built for Messrs. The Atlantica Sea Navigation Company, Limited, of London and Budapest. Each steamer will take the highest class in Lloyd's register and is of the following dimensions, *viz.*:—Length overall 342 ft., breadth 48 ft. 3 in., and depth 24 ft. 6 in., with extra long bridge, poop and topgallant forecastle. The saloon, state-rooms, captain's, officers' and engineers' rooms, etc., will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull of each vessel is built with deep frames, dispensing with hold beams and leaving large clear holds, cellular double bottom and large aft and fore peak ballast tanks, eleven steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large marine type donkey boiler, provision for shifting boards throughout, stockless anchors, telescopic masts, boats on beams overhead, electric light throughout, and a very complete outfit for a first-class cargo steamer. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders having cylinders 24 in., 40 in. and 65 in. dia. with a piston stroke of 42 in. and two large steel boilers for a working pressure of 180 lbs. per square inch. The ship and machinery have been built under the superintendence of Mr. D. M. Robson, of London, the owner's superintendent, and the ceremony of naming the steamers *Szterenyi* and *Magyarorszag* was gracefully performed by Mrs. Pollacsek, of Budapest, wife of the director-general of The Atlantica Sea Navigation Company, Limited.

Marcelle.—On March 2nd there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 120 ft. by 21 ft. 6 in. by 11 ft. 9 in. hold. The vessel, which has been built to the order of Messrs. Pecheries à Vapeur (Société Anonyme), Ostend, Belgium, has a whaleback forward, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes & Co., of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Marcelle* by Miss Green, of Selby.

Barbados.—On March 4th the steam fleeter *Barbados*, built to the order of the Hull Steam Fishing and Ice Co., Ltd., was launched from the yard of Earle's Shipbuilding and Engineering Company, Limited, Hull. The dimensions of the vessel are:—Length, 110 ft. 6 in.; breadth moulded, 21 ft. 6 in.; depth moulded, 12 ft. 7 in. She has been built under Lloyd's Survey for 100 A1 class steel, and is provided with the usual trawling outfit for this class of vessel, and has two large ballast tanks. The machinery will consist of a set of triple expansion engines having cylinders 10 in., 17 in., 28 in. diameter by 24 in. stroke, steam being supplied by a single-ended cylindrical boiler 10 ft. 9 in. diameter working at a pressure of 200 lbs. per square inch. The naming ceremony was performed by Mrs. Sturrock, and amongst those present were Mr. Beath, Mr. Somerscales, Mr. Tvacke, Mr. Sturrock and Mr. and Mrs. Palethorpe.

Steel Barge.—On March 4th the Blyth Shipbuilding Company, Limited, launched from their Shipbuilding and Graving Dock Works a steel barge, measuring 100 ft. by 28 ft. by 8 ft. depth moulded, which has been built to the order of Messrs. Lobnitz & Co., Ltd., of Renfrew, for the Blyth Harbour Commissioners. This barge will be specially fitted with powerful machinery by Messrs. Lobnitz for rock cutting, which will obviate the use of explosives. The hull has been built under the supervision of Messrs. J. Watt, Sandeman & Son, of Newcastle, the engineers to the Blyth Harbour Commissioners. A similar barge, built by the Blyth Shipbuilding Co., is already at work in the river Blyth, and is a pronounced success.

Acre.—On March 13th, Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, launched from their Thornaby Shipbuilding Yard, a handsomely modelled steel screw passenger and cargo steamer of the following dimensions, *viz.*, 311 ft. by 40 ft. 4 in. by 27 ft. 6 in. moulded to awning deck. She is being fitted up with passenger accommodation for 90 first-class passengers, including special cabins, smoke room, music room, etc. The music room is placed on the awning deck, with promenade deck and boat deck over same. The accommodation for third-class passengers is fitted up in 'tween decks aft, whilst the vessel will be fitted up in first-class style, including electric light, electric fans, electric bells, refrigerating machinery, Clayton fire extinguishing and disinfecting machinery. The upper decks are of steel sheathed with teak, whilst the lower decks are also sheathed. The first-class saloon, smoke room, music room, etc., will be magnificently fitted up in polished hardwood, suitably upholstered. In addition to carrying passengers, the vessel is adapted for carrying cargo and is equipped with six double powered steam winches, steam capstan, steam windlass, steam steering gear placed aft, worked by telemotors from the navigating bridges; large donkey boiler, etc. The engines have been constructed by Messrs. Blair & Co., Ltd., the cylinders being 25 in., 42 in., 68 in. by 45 in., with two large steel boilers working at 180 lbs. pressure, with bronze propeller, and all the latest improvements. The vessel has been built to the order of Messrs. The Lloyd Brazileiro, Rio de Janeiro, under the superintendence of Commodore J. C. de Carvalho, Captain A. Rosauro de Almeida, assisted by Mr. J. H. F. Tone. As the vessel left the ways, she was gracefully christened the *Acre* by Miss Regis d'Oliveira, daughter of the Brazilian Minister in London, representing the daughter of the Minister of Foreign Affairs for Brazil.

Kidwelly Castle.—On March 13th, there was launched from the shipbuilding yard of Mr. William Walker, Maryport, a finely modelled steam trawler, of the following dimensions: length, 120 ft., breadth 22 ft., depth moulded 12 ft. 6 in. The vessel is fitted with all the latest improvements for fishing vessels, including a whaleback forecastle and insulated fishhold. She will be fitted with machinery by Messrs. MacColl & Pollock, Sunderland. The vessel was named *Kidwelly Castle* by Miss Christie, Maryport.

Period.—On March 13th, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough, a fine steel screw steamer, built with Cantilever frames, on Harroway and Dixon's, John Priestman's and Livingston and Sanderson's patents, to the order of Messrs. Howard Smith Co., Ltd., of Melbourne, Australia, to fulfil the special requirements of the owners' extensive coal carrying trade. She is being built to 100 A1 at Lloyds and highest class at British Corporation, her leading dimensions being 339 ft. 9 in. by 45 ft. 2½ in. by 25 ft. moulded and she will carry about 4,550 tons on a light draught of water, with four exceptionally large hatchways 39 ft. 7 in. long by 28 ft. wide, with perfectly self-trimming and unobstructed holds. The vessel will be equipped with 12 powerful steam winches, 4 masts, 12 derricks, 6 gaffs and steam steering gear and will have 6 bulkheads, etc., and all the latest and most modern appliances for the rapid handling of cargo, in addition to which she will carry the unusually large quantity of 1500 tons of water ballast, located immediately under the deck in topside tanks as well as in the double bottom and peaks. She will be fitted with engines by Messrs. Richardsons, Westgarth & Co., Ltd., Middlesborough, having cylinders, 24 in., 40 in., and 66 in. by 42 in. stroke, supplied with steam by three large single ended boilers, working at 180 lbs. pressure. On leaving the ways, the vessel was gracefully named *Period* by Miss Betty Waynman Dixon, the younger daughter of one of the directors of the company. The steamer and her engines are being constructed under the superintendence of Mr. W. E. Forster and of Mr. M. Clare, resident inspector.

Annetta.—On March 14th there was launched from the Wallsend Shipyard of Swan, Hunter & Wigham Richardson, Ltd., a steel screw steamer, which has been built to the order of the Donald Steamship Company, and which is intended to run in the fruit service of the United Fruit Company between the West Indies and United States ports. The leading dimensions of the vessel are : length overall, 237 ft., beam, 31 ft. 8 ins., and depth moulded, 16 ft. The engines have been constructed by the North-Eastern Marine Engineering Co., Ltd., of Wallsend, and consist of a set of triple-expansion engines, having cylinders 21 in., 34 in. and 56 in., stroke 36 in., steam being supplied by two single ended boilers, working at a pressure of 180 lbs. The machinery is expected to drive the vessel at a speed of about 12½ knots in regular service. On leaving the ways the vessel was gracefully named the *Annetta* by Miss Hilda Hunter, daughter of the chairman of Swan, Hunter & Wigham Richardson, Ltd. This is the fourth vessel the builders have constructed for the same company.

Canterbury.—On March 15th, an important launch took place from the yard of the Northumberland Shipbuilding Co., Ltd., the vessel being a finely moulded steamer built to the order of Messrs. H. W. Dillon & Sons, London. The vessel is 372 ft. overall by 48 ft. beam extreme by 30 ft. 10 in. D.M. and has been built under special survey to the highest class at Lloyds Spar Deck Rule, with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation, which is very ample, being all placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops or emigrants may be carried if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes has been arranged for, consisting of derrick tables and outriggers, seven steam winches by Messrs. Clark, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, steam steering gear by Messrs. Hastie & Co., Greenock, and steam windlass by Messrs. Emerson, Walker and Thompson Bros. She is, of course, fitted with the usual water ballast arrangements for light passages. The vessel is designed to carry 7,300 tons dead weight on a moderate draught and steam about 10 knots loaded at sea. The machinery will be supplied by Messrs. the North-Eastern Marine Engineering Co., Ltd., Wallsend, the engines having cylinders 25 in., 41 in. and 69 in. by 48 in. stroke. Three large steel boilers, 14 ft. by 10 ft. 9 in., 180 lbs. working pressure. Mrs. H. W. Dillon gracefully performed the christening ceremony, naming the vessel *Canterbury*.

H.M.S. Mohawk.—On March 15th there was a successful launch from the works of Messrs. John Samuel White & Co., Ltd., East Cowes, Isle of Wight, of *H.M.S. Mohawk*, one of the new ocean going destroyers, building under the naval programme of 1905-6. The Company was represented by Mr. J. Lee White (managing director), and Mr. Robert Farquhar (director and shipyard manager), who was in charge of the launching arrangements ; and the Admiralty by the following officials : Mr. H. G. White (Admiralty hull overseer), Eng. Lieut. H. E. Rock, R.N. (Admiralty engineer overseer) ; Mr. Andrew Lobb (assistant hull overseer) ; Mr. Smart (assistant hull overseer) and Mr. H. A. Densumbe (Admiralty overseer). The following are the principal particulars of the vessel : length, 270 ft. ; displacement, 800 tons ; armament, 3-12 pdr. Q.F. guns, 3-18 in. revolving torpedo tubes. Speed to be maintained on a six hours' full power trial, 33 knots. Radius of action at economical speed, 1,500 nautical miles. The vessel will be propelled by turbine machinery, comprising 5 turbines (3 ahead and 2 astern), driving 3 shafts and propellers, built by Messrs. J. S. White & Co., Ltd., under licence from Messrs. The Parsons Marine Steam Turbine Co., Ltd., the power of the machinery being about 14,500 I.H.P. The steam will be supplied by six boilers, each of about 2,400 H.P. of the " White-Forster " type, made by the same firm, these boilers being fired by liquid fuel on a system which has been experimented with success by the British Admiralty for some two or three years. No coal stowage is provided in the vessel and she will rely entirely on the liquid fuel installation. The air pumps, forced lubrication pumps, boiler feed pumps, oil fuel pumps, fire and bilge pumps and distilling plant are being supplied by Messrs. G. & J. Weir, Ltd., Glasgow, the fans and circulating engines by Messrs. W. H. Allen, Son & Co., Ltd., of Bedford, and the air compressing machinery and electric light plant by Mr. Peter Brotherhood, Westminster Bridge, London, S.E.

Lord Claud Hamilton and **Lord Charles Beresford.**—On March 16th there were launched from the shipyard of Messrs. Cochrane & Sons, Shipbuilders, Selby, two handsomely modelled steel screw drifters, the principal dimensions being 82 ft. by 18 ft. 3 in. by 9 ft. moulded. The vessels have been built to the orders of Messrs. The Lowestoft Steam Herring Drifters Co., Ltd., of Lowestoft, and will be fitted with compound engines by Messrs. Crabtree & Co., Ltd., of Great Yarmouth, and are replete with all the latest improvements for fishing purposes. As the vessels left the ways they were gracefully christened *Lord Claud Hamilton* by Miss Cargill, of Hessle, and *Lord Charles Beresford* by Miss F. G. Massey, of Hull, after which the company adjourned to the builders' offices, where the customary toasts were given and responded to.

Richmond.—On March 16th Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., launched from their shipyard, West Hartlepool, a finely modelled steel screw steamer built to the order of Messrs. The Chesapeake and Ohio Steamship Company, Limited, London. She is of the following dimensions :—330 ft. by 47 ft. by 24 ft. 10 in., having a continuous shelter deck and upper deck, and has been built to Lloyd's highest class under special survey. A double bottom is fitted throughout on the cellular principle, and the fore and after peak tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stringers, giving clear holds for the storing of bulky cargoes. Five water-tight bulkheads divide the holds into six water-tight compartments, and wood grain divisions are fitted in the holds. She also has extra large hatches, steam winches which are supplied with steam from a vertical multitubular donkey boiler and is replete with all the latest improvements for rapid loading and discharging. A powerful quick warping steam windlass is fitted forward for the working of the cables, and steam steering gear is fitted amidships with hand screw gear aft. Accommodation for captain and officers is arranged aft under shelter deck, engineers in houses alongside casings, crew and firemen in forecastle. The sanitary, ventilating and lighting arrangements have received special attention, and have been effected on the most approved lines. Triple expansion engines are being supplied by Messrs. Richardsons, Westgarth & Co. Ltd., Hartlepool, having cylinders 24 in., 38 in., 64 in. by 42 in. stroke, 2 large S.E. boilers 160 lbs. pressure. Amongst those present at the launch were Rev. James and Mrs. Colville, Mr. and Mrs. J. J. C. Warwick, Mr. and Mrs. Wm. Copeman, Misses Warwick, Miss Copeman, Mrs. and Miss Henderson, Mr. R. Warwick, Miss, Busby, Mr. and Mrs. A. S. Purdon and Mr. J. T. Harris. As the vessel left the ways the christening ceremony was gracefully performed by Miss Copeman, who named the vessel *Richmond*.

Vine.—On March 18th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter, the principal dimensions being 80 ft. by 18 ft. 6 in. by 9 ft. 6in. moulded. The vessel has been built to the order of Messrs. Thomson & Murray, of Buckie, and will be fitted with compound engines by Messrs. The Great Central Co-operative Engineering and Ship Repairing Co., Ltd., of Grimsby, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Vine* by Miss Jack, of Beverley, after which the company adjourned to the builders' offices where the customary toasts were given and responded to.

Grenada.—On March 19th the steam fleeter *Grenada*, built to the order of the Hull Steam Fishing and Ice Co., Ltd., was launched from the yard of Earle's Shipbuilding and Engineering Company, Limited. The dimensions of the vessel are : Length, 110 ft. 6 in., breadth moulded, 21 ft. 6 in. ; depth moulded, 12 ft. 7 in. She has been built under Lloyd's survey for 100 A1 class steel, and is provided with the usual trawling outfit for this class of vessel, and has two large ballast tanks. The machinery will consist of a set of triple expansion engines having cylinders 10 inches, 17 inches, 28 inches diameter by 24 inches stroke, steam being supplied by a single ended cylindrical boiler 10 ft. 9 in. diameter, working at a pressure of 200 lbs. per

square inch. The naming ceremony was performed by Miss Beatrice Ford, and amongst those present were Mr. and Mrs. Beath, Mr. Exley and Messrs. Tyacke, Palethorpe and Sturrock.

LAUNCHES—Scotch.

Rossmore.—On February 25th there was launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, a steel screw steamer of the following dimensions:—Length, 180 ft.; breadth, 27 ft. 6 in.; depth moulded, 13 ft. 8 in. with long raised quarter deck, bridge and topgallant forecastle. The vessel has been specially designed for the coasting trade being classed 100 A1 at Lloyds with scantlings largely in excess of requirements, water ballast is fitted throughout the length of the hold and also in both peaks, the officers' accommodation is all fitted in polished hardwood, whilst the crews' berths are of the galvanized tubular type. The hatches are built on the self trimming type and steam steering gear and steam capstan are fitted. The engines are compound surface condensing of large power, and will be fitted on board by Messrs. Ross & Duncan, Govan. The launching ceremony was gracefully performed by Miss Etta Hutton Langbank, who named the vessel *Rossmore* and it is the third vessel the owners, Messrs. Murray, McNab and Co., have had built in the same yard. During construction the machinery has been built under the supervision of Mr. George F. Duncan Glasgow

Wakioa.—On March 1st there was launched at Messrs. Ramage & Ferguson, Ltd.'s shipyard, Leith a very fine twin screw steam yacht of 900 tons measurement for Mr. L. V. Harkness, of New York, to designs by and under the superintendence of Messrs. Cox & King, Pall Mall, London. The dimensions of the yacht are:—Length overall, 240 ft. by 30 ft. 6 in. breadth. She is of the shade deck type built to Lloyds' highest class with cellular double bottom and topgallant forecastle, which latter gives her a very handsome and powerful appearance. The owner's accommodation embraces dining, drawing, smoking and other reception rooms, of unusually fine proportions, as well as a number of elegant state and toilet rooms, and surgery, all of which are treated in style regardless of cost. She is installed with complete systems of steam heating forced ventilation electric light, bells and telephones and refrigerating and cold storage for making extended cruises. A very fine electric laundry also is built in the forward part of the ship. Quick firing guns and searchlights are mounted on the upper deck. The yacht is the first to be fitted with Lord Kelvin's patent electrical sounding machine as fitted in the battleship *Dreadnought*. The propelling machinery consists of two sets of triple expansion engines, supplied by steam of 185 lbs. pressure from two large marine type Scotch boilers. An equipment of fast motor launches and lifeboats, etc., is carried, besides 2 deck lifefloats. The completion of the yacht is to be pushed forward with all possible despatch to enable the owner and his party to commence a voyage around the world. As the yacht left the ways she was named *Wakioa* by Mrs. Harry Harkness, the owner's daughter-in-law, who had come to Europe for the purpose. Mr. L. V. Harkness is at present the owner of s.y. *Wakioa*, 455 tons, built in 1903 by Messrs. Ramage & Ferguson, Ltd. from designs by the same architects.

Mount Sephar.—On March 4th Messrs. Alex. Stephen and Sons, Ltd., launched from their yard at Linthouse a large cargo steamer for Messrs. Smith & Service, of Glasgow. The principal dimensions are as follows:—Length, 400 ft.; breadth, 52 ft.; depth moulded, 29 ft. 9 in.; and she has been designed under Lloyd's rules to carry about 8000 tons deadweight on a moderate draught. She has a very large cubic capacity, and all her fittings have been arranged for the handling and reception of large and bulky cargo. Her fittings have been arranged under the supervision of Mr. Niccol, naval architect, of Glasgow; and to suit the special requirements of her intended trade. To facilitate the handling of cargo, Messrs. Smith & Service have adopted a system of twin masts, which combines all the advantages of Samson posts, with the extra height and strength of ordinary masts, and enables the vessel to deal unaided with bulky machinery of enormous weight, lifting it out of the holds and putting it clear over the side. The propelling machinery, which is also being constructed at Linthouse, will consist of a set of triple expansion engines with cylinders 26 in., 42 in. and 70 in. diamter by 54 in. stroke, supplied with steam from three single-ended boilers, working at 180 lbs. pressure with Howden's forced draught. Wailes, Dove and Co.'s bitumastic enamel was applied to internal surfaces of boiler room tank. The vessel was named the *Mount Sephar* by Mrs. Wm. Service, 1, Queen's Gate, Dowanhill.

Makambo.—On March 16th there was launched from the Port Glasgow yard of the Clyde Shipbuilding and Engineering Co., Ltd., a steel passenger and cargo steamer to the order of Messrs. Burns, Philp & Co., Ltd., of Sydney, New South Wales. The vessel is 210 ft. by 31 ft. 3 in. by 17 ft. 3 in., classed 100 A1 at Lloyds' to the spar deck rule, and has a deadweight capacity of 1400 tons on a draught of 16 ft. 6 in., designed for trading in the New Hebrides. Accommodation is provided in two berth cabins for 28 1st class and 20 2nd class passengers. The machinery, constructed by the builders, is designed for a speed of 10½ knots, with cylinders 17 in., 23 in. and 42 in. dia. by 33 in. stroke. Steam at 180 lbs. pressure is supplied from two cylindrical boilers 10 ft. 6 in. dia. by 10 ft. 3 in. long, having two furnaces each, a Cochran donkey boiler is also fitted. The christening ceremony was performed by Miss Adamson, London, niece of the owner's superintendent, Mr. James McCartney, under whose supervision the vessel is being built and engined. After light refreshments had been partaken of and the usual toasts proposed and responded to, Miss Adamson was presented with a handsome gold bracelet by the builders and an ornamental buckle on behalf of the owners, as souvenirs of the occasion.

LAUNCHES—Irish.

Avon.—On March 2nd Lady Pirrie gracefully performed the ceremony of naming the fine large twin-screw mail steamer *Avon*, launched from the yard of Messrs. Harland and Wolff, Belfast, for The Royal Mail Steam Packet Company. The launch of this steamer emphasises the progressive policy of The Royal Mail Steam Packet Company, one of the oldest, and now recognised as one of the most efficient of British steamship lines. In addition to being one of the finest vessels in the R.M.S.P. fleet, the *Avon* will be the largest steamer engaged in the South American trade. Her dimensions are:—Length, 534 ft. 9 in.; beam, 62 ft. 4 in., with a gross register of about 11,000 tons. The *Avon* is designed to carry a large quantity of cargo, but passenger accommodation on the most sumptuous scale is her speciality; a point deserving particular mention is that the state-rooms are on deck, an improvement that will appeal strongly to intending voyagers. Many of the cabins are arranged on the tandem principle with side lights for each room. Single berth cabins are a feature in the *Avon*. There are a number of *suites de luxe* (a feature of the R.M.S.P. steamers), and these are to be magnificentiy furnished in white and gold with silk panellings. The first-class dining saloon bids fair to surpass the most handsome afloat. The tables—seating 250 passengers—are arranged on the latest restaurant system. The elegance of the whole structure, combined with the magnificent stairway and approach to the main deck, forms a rare example of marine architectural beauty. The style is renaissance—in oak, white and gold furnishing adorned with cupids and sea trophies. The dome, modelled after that of the Genoese Palace, is most ornate and brilliantly lighted; and the saloon is specially ventilated by a very complete arrangement of electric fans. The decorations of the social hall and lounge, situate on the promenade deck, are in oak, the structure being surmounted by two domes of stained glass. The smoke rooms (upper and lower) are on the promenade and boat decks aft, and are exceptionally well ventilated; they are decorated with Dutch tiles giving views of the different places of interest in the ports and countries to which the Company's vessels trade, the woodwork being carried out in oak panelling handsomely carved. The arrangement of the rooms is very attractive and comfortable, with a staircase leading from one to the other, and the popular "well" formation, giving a balcony to the upper room. The rooms are also mechanically ventilated with 12 electric fans. A nursery adjoins the first saloon on the main deck. The second saloon accommodation includes

handsome dining saloon, drawing and smoke rooms on deck, and ample promenade accommodation. The third-class accommodation provides for a large number of passengers, whose comfort in sleeping rooms, dining rooms, lavatories, and deck space is well catered for. Every provision has been made for the safe navigation of the steamer, and by the adoption of Messrs, Harland & Wolff's latest "balanced" quadruple type of engines vibration is reduced to a minimum, The double set of engines for the twin-screws constitutes, of course, an additional element of safety. The *Avon* is a schooner rigged vessel with two masts, and her graceful lines and fine appearance excite admiration. She is an eloquent tribute to the high hopes entertained by The Royal Mail Steam Packet Company of the future of the South American trade, and cannot fail to meet with unqualified approval of the travelling public and merchants for whose comfort she has been built. The *Avon* will take up her position in the South American Mail Service on the 14th June next.

Ceara.—On March 16th, Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their South Yard, the first of six steamers being built by them for the Lloyd Brazileiro, of Rio de Janeiro, of which company Dr. Manuel Buarque de Macedo is the chairman. The ceremony of naming the vessel *Ceara* was undertaken by Senhora Affonso Penna, the wife of the President of the Brazilian Republic, who deputed Senhora Regis d'Oliveiro, the wife of His Excellency the Brazilian Minister in London to perform the ceremony on her behalf. A large and distinguished company assembled to witness the launch, amongst those present being His Excellency the Brazilian Minister; his daughter, Senhorita Regis d'Oliveira; Dr. F. B. Lacerda Cavalcanti; Dr. J. F. de Barros Pimental; Dr. R. de Lima e Silva; Commodore C. F. Carvalho; Commandor A. Rosaura de Almeida; Commandor Armando Cesar Burlamaqui; Colonel Haynes; Mr. Luiz Buarque; Dr. and Senhora Pizarro; Mr. George White; Mr. and Mrs. Frank Workman; Mr. Charles E. Allan; Mr. and Mrs. John Workman, etc. The *Ceara* is 354 feet in length, and has a gross tonnage of about 3,500 tons built under Lloyds Special Survey to qualify for their highest class; the new vessel also fulfils the Board of Trade requirements for a foreign-going passenger steamer. In the design and arrangement of the vessel, the special requirements of the South American coast passenger and cargo trade have been carefully considered, and when completed, she will be found to be a most comfortable and luxurious steamer. Accommodation will be provided for upwards of 170 first-class passengers, 20 second-class and 300 third-class. The first-class state-rooms are placed in the upper deckhouse and on the main deck; a number of cabins de luxe are also provided, these include a large sitting room, bedroom, lavatory and bath room. All these rooms are large, airy and well-lighted apartments. The first-class dining saloon is situated on the main deck and extends the full width of the vessel. A wide staircase leads from this saloon to the main entrance hall on the upper deck. This hall will be used as a lounge, and from it broad central corridors run fore and aft with the staterooms opening off on each side. The cabins de luxe are placed round the entrance hall. Large double doors on each side open out on to the deck. The main staircase continues up from this deck to the shade deck entrance hall. Opening off the forward end of this hall is the music saloon, and off the after end is the smoke room; both of these apartments are large, lofty and well lighted, and will be suitably furnished. On each side of the hall, wide double doors open out on to the shade deck, where ample promenading space is provided. A number of additional first-class state rooms and the officers' rooms are placed in the deckhouse at the forward end of the shade deck. The second-class passengers' rooms are situated on the main deck forward of the boiler casing. The dining saloon is arranged in the centre of the vessel with the state rooms opening off on alley-ways on each side. The steerage quarter are fitted up at the forward end of the main deck and include a separate room for women. A portion of the steerage space will be fitted up with iron beds and a portion with hammocks swung from the beams. The engineers and petty officers' rooms are placed in the midship house on the upper deck, while the crew are berthed in the top gallant forecastle. The sanitary arrangements for each class are receiving special attention, while the galleys and pantries will be provided with the most modern appliances. Electric lighting will be fitted throughout the vessel, while all the living compartments and public rooms will be well ventilated by natural and artificial means. The cargo space is divided into four holds, by watertight steel bulkheads, which extend to the upper deck. The holds are fitted with suitable hatchways, equipped with eight powerful hydraulic cranes, capable of rapidly loading and discharging the cargo. Baggage and parcel rooms have been arranged for passengers' luggage, and mail and bullion rooms are being fitted up. The propelling machinery is being constructed in Messrs. Workman, Clark and Co.'s Queen's Road Works, and consists of two sets of triple expansion engines with all the latest improvements, and three steel cylindrical multitubular boilers, working under Howden's system of forced draught. An auxiliary boiler is provided for supplying steam for the auxiliary engines and deck machinery. The designing of the vessel and machinery, and the construction have been carried out with the co-operation and under the superintendence of Mr. A. Rosauro de Almeida, Commander Engineer of the Brazilian Navy, who is the Technical Director in Chief for the Lloyd Brazileiro. After the ceremony of naming the vessel had been gracefully performed by Senhora Regis d'Oliveira, the company drove to the Grand Central Hotel, where luncheon was provided.

TRIAL TRIPS.

B.F.—On February 19th the fine new steel screw steamer *B.F.*, built by Messrs. Wood, Skinner & Co., Ltd., of Bill Quay-on-Tyne, to the order of MM. Brenton Frères, of Valogne, for their special coasting trade, left the Tyne for her official trial trip. This vessel, which is of the raised quarter deck type, with ballast in peaks and tanks in bottom, is rigged as a fore and aft schooner, and has been built to the requirements of the French Government, and has all the latest appliances for facilitating the rapid loading and discharging of cargo. The propelling machinery has been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, and is of the triple expansion type with high pressure boilers. During the trial run very heavy weather was experienced, but the vessel behaved exceedingly well and maintained a speed of 10 knots, which was considered most satisfactory by all concerned, amongst those present being Mr. Collett and Mr. Collet, jun., representing the owners, Mr. Jos. Reed, representing the French Government, Mr. Skinner and Mr. Leslie Skinner, representing the shipbuilders, and the engine builders by Mr. J. Daglish.

Farley.—On February 23rd the fine steel screw steamer *Farley*, built by the Northumberland Shipbuilding Company, Limited, Howdon-on-Tyne, to the order of Messrs. Houlder, Middleton & Co., London, for the Reliance Shipping Co., Ltd., left the Tyne for her trial trip, this being the fourth of a fleet of steamers built by the same firm for this new company. The steamer is 372 ft. long by 48 ft. beam by 30 ft. 10 in. deep, and has been built under special survey to the highest class at Lloyds' Spar Deck Rule with extra strengthening for special freeboard. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation, which is very ample, being placed in steel houses on the bridge deck, whilst the poop is fitted up for Lascar crew requirements. The 'tween decks are lofty and so arranged that cattle, troops or emigrants may be carried if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of 8 steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, and steam windlass by Messrs. Emerson, Walker & Thompson Bros. She is fitted, of course, with the usual water ballast arrangements for light passages, and is lighted throughout by electricity. She has been constructed to a fine model with a view to rapid speed

and economy in fuel, and the machinery has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in. and 69 in. by 48 in. stroke, three large steel boilers 14 ft. by 10 ft. 9 in., 180 lbs. pressure. Messrs. S. T. Taylor & Sons have covered the boilers, pipes, cylinders, etc., with their Tynos non-conducting material. The vessel will carry about 7300 tons deadweight. The trial trip proved in every way satisfactory, and a speed of 11 knots was easily obtained. Among the guests on board were the following :—Mr. J. Graham, representing the builders, and Mr. J. Russel, representing the engineers.

Chipana.—On March 8th the s.s. *Chipana* (of which we gave particulars in our January issue, page 237), lately completed by Messrs. Short Brothers, Limited, Sunderland, to the order of Messrs. Grace Brothers & Co., Limited, London, left the Tyne for her official trials. The vessel has been built to Lloyd's highest class, under the inspection of Mr. Donald Mathieson, and Mr. William Dodds, of Newcastle, the superintendent engineers. On her trial runs the steamer made a speed of 12¼ knots.

Cooma.—On March 12th the steel screw steamer *Cooma* (of which we gave particulars in our February issue, page 271), built by Messrs. Alex. Stephen & Sons, Ltd., to the order of Messrs. Howard Smith Company, Ltd., of Melbourne, for service in Australasian waters, ran her official trials in the Firth of Clyde, which were of the most satisfactory nature throughout; everything worked without a hitch from start to finish, and a speed of 15 knots was obtained, which is about a half knot in excess of the owners' requirements. There was a large company on board including Mr. A. E. Stephen and Mr. F. J. Stephen, representing the builders, Mr. W. E. Forster and Captain Leslie, of the Howard Smith Company; and also representatives from the other shipping companies engaged in the Australian trade, Mr. Foster King, of the British Corporation, and others.

Gando. On March 12th this new steamer, the latest addition to the fleet of Messrs. Elder, Dempster & Co., Liverpool, and built by Messrs. Workman, Clark & Co., Limited, Belfast, left the Spencer Basin and proceeded down the Belfast Lough for speed trial and adjustment of compasses, after which she left for Liverpool, and will shortly take her place on the owners' West African Coast service. The *Gando* is a vessel of over 3800 gross tonnage, and has been built under the special survey of the British Corporation of shipping for their highest class, she also fulfils the requirements for a Board of Trade passenger certificate. Accommodation for a number of first-class passengers has been provided in the bridge house. All the state rooms are large and comfortable apartments placed along the ship sides, thus securing perfect ventilation and lighting; these rooms are replete with every convenience necessary for the comfort of passengers. The dining saloon, a commodious and well-lighted apartment situated in the centre of the vessel, is tastefully decorated and comfortably furnished. A stairway from the corridor at the after end of the saloon leads to the entrance hall on the bridge deck. Opening off this hall is the smoke-room, a comfortable and well-appointed apartment. Second-class passengers' accommodation has been fitted up in the poop, and includes comfortable state rooms and a dining saloon with the necessary pantry and stewards' quarters. The officers' and engineers' rooms have been arranged along the ship's sides at the after end of the bridge space, while the crews' quarters, which include a special feature in the way of separate mess rooms and wash houses for the firemen and seamen, are fitted up in the forecastle space. The four large holds, into which the cargo space is divided, are capable of receiving the largest type of consignment, such as locomotives, boilers and general machinery. Each of these holds has a large hatchway furnished with a couple of steam winches of the most powerful type, together with the necessary derricks swung from the masts. The propelling machinery includes a set of triple expansion engines, and three multitubular steel boilers fitted with Howden's system of forced draught. The construction of the hull and machinery has been carried out under the supervision of Captain Thompson and Mr. Wilkie, marine and engineering superintendents for the Elder, Dempster Line.

Trecarrell.—On March 16th the new screw steamer *Trecarrell* (of which we gave particulars in our March issue, page 308), built and engined by Messrs. John Readhead and Sons, West Docks, South Shields, to the order of the Hain Steamship Co., Ltd., St. Ives, was taken to sea on her official trial trip, which was in every way satisfactory to all concerned. After the trial the vessel proceeded to Cardiff to load for the Mediterranean under the command of Captain Blackie.

Roanoke. On March 13th the finely modelled clipper-stemmed steamer *Roanoke* was taken on her official trial trip off Hartlepool. She has been built to the order of Messrs. The Chesapeake and Ohio Steamship Co., Ltd., London, by Messrs. Furness, Withy & Co., Ltd., Hartlepool, and will be employed in the Rotterdam-Antwerp to Baltimore general trade. The vessel is built on the shelter deck principle with a tier of beams, exceeds 367 feet in length, and takes highest class in British Corporation Register, the deadweight exceeding 7000 tons, and she has large measurement capacity. The hatches are large, allowing of bulky stowage in holds and the 'tween decks are available for the carrying of live cattle. Cellular double bottom is arranged all fore and aft, and a large deep tank fitted just aft of the engine room bulkhead, in addition to the large after peak being available for water ballast will enable the vessel when required to make a light Atlantic voyage with safety, the total water ballast being thus available exceeding 2000 tons. She is most efficiently ventilated throughout; special attention has been given to all derricks and lifting gear; she has nine powerful steam winches, steam ash hoist, winch condenser, steam heating in all midship accommodation, and her equipment throughout includes all the most modern auxiliaries pertaining to a first-class up-to-date cattle and cargo steamer. the vessel is a duplicate of the s.s. *Rapidan*, recently launched by Messrs. Furness, Withy & Co., Limited. Triple expansion engines (which worked very smoothly throughout the trials) have been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, the sizes of cylinders being 25 in., 40 in., 68 in. by 48 in. stroke, with three single-ended boilers 14 ft. 6 in. by 11 ft. long and 180 lbs. working pressure, boilers constructed to German Law requirements. The trial trip was most satisfactory, the vessel attaining a speed of 11 knots. The owners were represented by Messrs. A. H. Walker and T. Tose, and the builders by Messrs. F. Bolton and T. E. S. Robson.

Saxo.—On March 13th the new steamer *Saxo*, built by the Sunderland Shipbuilding Company, Limited, was taken to sea upon her official trial; the principal dimensions are 190 ft. by 29 ft. 10 in. broad by 13 ft. deep, having raised quarter deck, bridge and topgallant forecastle, classed British Corporation, under special survey, deadweight capacity 900 tons upon a light draught of water. Accommodation is placed in the poop for captain and officers, and the accommodation for engineers is amidships and the seamen and firemen in forecastle as usual; a donkey boiler is supplied for working the deck machinery, which consists of three steam winches, steam steering gear and direct steam windlass. The machinery has been supplied by Messrs. MacColl & Pollock, Sunderland, and has cylinders 20 in., and 44 in. by 27 in. stroke, with one large boiler. The vessel has been built to the order of Det Forenede Dampskibsselskab Aktieselskab of Copenhagen. Mr. Host and Mr. O. E. Tuchesen (representing the owners) were present on the trial, and expressed themselves as highly satisfied with the result, everything working without a hitch, a mean speed of 10¼ knots being obtained.

Norfolk.—On March 16th the fine steel screw steamer *Norfolk* (of which we gave particulars in our March issue, page 308), built by the Northumberland Shipbuilding Co., Ltd., Howden-on-Tyne, and engined by Messrs. George Clark, Ltd., Sunderland, for the Furness Line, left the Tyne for her trial trip, which proved in every way satisfactory, and a speed of 12 knots was easily obtained. Among the guests on board were the following :—Mr. A. H. Walker and Mr. T. Tose, representing the owners, Mr. J. Graham, representing the builders, and Mr. Russell representing the engine builders.

Voltaire.—On March 16th the large screw steamer *Voltaire* (of which we gave particulars in our March issue, page 310), built and engined by Messrs. David & William Henderson, and Co., Ltd., Partick, to the order of Messrs. Lamport and Holt, Liverpool, underwent a successful trial trip on the Firth of Clyde. The owners were represented by Mr. George Melly and Mr. Heywood Melly, and their superintendents, Captain Bird, Mr. J. Russell and Mr. J. Dall. During the trial everything worked well, and to the satisfaction of owners and builders, a mean speed of about 13 knots being easily attained between the Cloch and Cumbrae lighthouses.

Torpedo Boat No. 9.—The launch of Torpedo Boat No. 9 (lately known as H.M.S. *Grasshopper*) at the Chiswick yard of Messrs. John I. Thornycroft & Co., Limited, on March 18th, is an event of considerable interest, from the fact that it is the fifth of the new class of British turbine-driven torpedo boats constructed at this yard, and in addition marks the end of the long and notable list of torpedo craft which has been constructed by this firm at their Chiswick Works, commencing with the *Lightning*—known in the service as torpedo boat No. 1—which was delivered in 1877. The *Lightning* was a boat of 85 ft. in length, and capable of a speed of 18 knots, which was then considered most remarkable. Torpedo boat No. 9 is 168 ft. long with a beam of 17 ft. 6 in. and a draught, under fully loaded conditions, of 5 ft. 11 in. She is fitted with Parson's turbines and Thornycroft boilers using oil fuel; both the turbine machinery and boilers being constructed by Messrs. Thornycroft. The contract speed is 26 knots, but in the case of the four earlier boats which have already undergone trials, this speed has been exceeded by considerably over a knot. The armament consists of two 12-pounder quick-firing guns and three torpedo tubes. Torpedo boat No. 8, one of the sister vessels, having successfully carried out all her trials, was handed over to the Admiralty officials at Sheerness by Messrs. Thornycroft on March 16th. Messrs. Thornycroft now propose to carry out all work of this nature at their Woolston Works, Southampton, where they are much more favourably situated than at Chiswick.

BOARD OF TRADE EXAMINATIONS.

Note—1C denotes First Class; 2C Second Class.

February 23rd, 1907.

Beynon, H. A. V.	1C	Cardiff
Black, John....	1C	Glasgow
Boggon, Robert	1C	N.Shields
Bowman, G. C	2C	Liverpool
Brown, Arch. ..	2C	South'ton
Calcaterra, L. I.	1C	London
Cameron, A. A	1C	Glasgow
Coles, Alfred ..	1C	London
Cowie, William	2C	N.Shields
Cutlack, Alf. L.	1C	London
Davies, Harry	1C	Liverpool
Dudgeon, R. W	1C	Liverpool
Dunn, J. M. M	1C	W.Hart'l
Eales, Thos. R.	1C	W Hart'l
Froude, D. G...	2C	Cardiff
Gallon, Thos. ..	2C	W. Hart'l
Galloway, J. A. W	2C	Liverpool
Gowans, John ..	2C	N.Shields
Green, Chas L.	2C	W. Hart'l
Hamilton, J. G.	2C	Glasgow
Harrison, G. E	1C	London
Haslam, Ed. V.	2C	N.Shields
Irvin, Geo. F. .	2C	W. Hart'l
Jenkins, Jas. R.	1C	Cardiff
Kelly, Thos. A.	2C	Liverpool
Ladley, M. A.	2C	Cardiff
Lawson, H. F. .	1C	Liverpool
Macmeikan, R. A.	2C	London
Manfield, W. G.	2C	London
Martin, Peter ..	1C	Liverpool
Menlove, G. A.	1C	Liverpool
Mitchell, Walter	1C	Glasgow
M'Larty, A. D.	2C	South'ton
Morrow, H. B. .	2C	N.Shields
Nimmo, G. W.	2C	N Shields
Ollerenshaw, J. T	1C	Liverpool
Parker, William	1C	Liverpool
Perry, Fred. W	2C	Cardiff
Plater, James J.	2C	Cardiff
Prentis, John C.	1C	Cardiff
Rennie, Jas. M	2C	Liverpool
Reynard, Ernest	2C	W Hart'l
Robinson, M	1C	N Shields
Robson, John F.	1C	N.Shields
Rogers, H. V.	2C	London
Ross, Alexander	1C	Leith
Royal, Robert .	2C	W. Hart'l
Savage. James	1C	Leith
Shewan, David	2C	Glasgow
Small, E R G H	1C	London
Spanudakis, C.	2C	N.Shields
Stevenson, J. W.	1C	Liverpool
Stewart, W.M.'K	2C	Glasgow
Stirling, Geo. F.	2C	Leith
Summers, W. J.	2C	Liverpool
Thomas, H. P.	1C	Cardiff
Turnbull, R. R.	2C	Liverpool
Urquhart, John	1C	Glasgow
West, Wm. J...	2C	London
Williamson, A.	2C	Glasgow
Wright, N. L...	2C	South'ton

March 2nd.

Arnott, A D ..	2C	Greenock
Barnett, Wm J	2C	Aberdeen
Bicknell, Ed H	1C	Liverpool
Boyd, James H.	1C	Liverpool
Bruce, Jas. W.	1C	Liverpool
Burchall, F. J.	1C	N Shields
Connell, C. E	1C	Liverpool
Cooper, John C	1C	Hull
Cruickshank, G.	2C	Aberdeen
Dadley, Wm. ..	2C	Liverpool
Dickinson, R. ..	1C	Bristol
Dodds, William	1C	N.Shields
Fraser, Arthur	1C	Liverpool
Fraser, James ..	2C	Aberdeen
Gall, John	2C	N.Shields
Gray, James ..	2C	Aberdeen
Hallyburton, S.	1C	Liverpool
Ham, John	2C	London
Haven, Frank A.	2C	London
Hill, Alfred A. .	2C	Liverpool
Hughes, Wm...	1C	Bristol
Hunt, Thos. J.	2C	Bristol
Kelly, Michael	1C	Liverpool
Kerr, Adam	1C	London
Kerr, David S.	2C	Greenock
Kincaid, J. G...	1C	Greenock
Legge, William	1C	Aberdeen
Lightfoot, F. ..	1C	N.Shields
Lightburn, T. F.	2C	Liverpool
Lowther, Geo .	2C	Hull
Malcolmson, J. H	1C	London
Mason, Tom. S.	1C	Hull
Marwick, Thos.	2C	N Shields
Nicol, R. G. ..	2C	London
Nicholson, H. E	1C	Hull
Purvis, Robt. J.	1C	N.Shields
Sangster, W. J.	2C	Aberdeen
Scott, W. T. R.	1C	Sunderl'd
Slee, Herbt T	2C	N.Shields
Smethurst, Max	2C	Hull
Smith, Geo. W.	2C	London
Softley, Joseph	2C	N.Shields
Sutherland, A J	2C	London
Tate, Frank W	1C	N.Shields
Turnbull, W. McK	1C	Greenock
Warren, Christ.	2C	Sunderl'd
Watson, Jas B	2C	Greenock
Welsh, David F	1C	N.Shields
Wilson, Sam. A	2C	Sunderl'd
Woodhall, T. S.	2C	Sunderl'd
Woodcliff, D.W.	2C	Bristol
Young, John W.	2C	Liverpool

March 9th

Andrew, Jas P	2C	Glasgow
Barnes, Albt. E.	2C	South'ton
Black, Albert G.	1C	N.Shields
Bowman, T. A.	2C	N Shields
Burgess, P. E. .	2C	N.Shields
Cacaroukas, M P	1C	Leith
Calley, Wm. T.	1C	Liverpool
Cameron, Wm.	1C	London
Charlesworth, J.	2C	Liverpool
Churchill, J. P.	2C	Cardiff
Clarke, H. S. ..	2C	Falmouth
Clarkson, John	1C	Glasgow
Cockeram, H ..	1C	Leith
Curry, Chas J.	1C	Belfast
Dick, James B.	1C	Glasgow
Donaldson, J. ..	1C	Leith
Duncan, Alex...	2C	Glasgow
Fentiman, P. E.	1C	Cardiff
Gateshill, H. C.	1C	N.Shields
Grandfield, I. J	2C	Cardiff
Green, Alf. E...	2C	N.Shields
Hancock, R. J.	2C	London
Hillan, Peter ..	1C	Glasgow
Huntley, John ..	1C	N.Shields
Jenkins, John ..	2C	Cardiff
Jones, John T..	2C	London
King, Joseph A.	1C	London
Laine, Jas. A...	1C	Leith
Lockhead, Robt.	1C	Glasgow
Lundie, William	1C	Leith
MacNeil, A H.	2C	Glasgow
Maclure, Chas .	1C	Belfast
M'Collin, Jas C	1C	London
M'Laren, W. P.	1C	Glasgow
Morton, Wm. T.	2C	Belfast
Papageorgion, Joannis A	1C	Liverpool
Parry, Robert .	2C	N.Shields
Prettyman, A..	2C	Cardiff
Ramsay, G. F..	2C	Leith
Redcliff, C. A..	2C	Cardiff
Robertson, J ..	2C	Leith
Rodaway, Geo.	2C	Cardiff
Roy, Arch W	1C	Glasgow
Selby, Charles	1C	Glasgow
Senbert, K. W	2C	London
Shaw, Oliver E.	1C	London
Shepherd, J. ..	1C	Liverpool
Sim, George ..	1C	Glasgow
Smith, Donald	1C	Glasgow
Smith, George	2C	Glasgow
Stafford, J. W.	1C	Glasgow
Twist, Wm. C	2C	London
Watson, W. H.	1C	Glasgow
White, Bertie R.	2C	Falmouth
Williams, Ira ..	2C	Cardiff
Wood, James ..	2C	London

March 16th.

Bond, John E.	1C	Liverpool
Bow, Thomas ..	1C	Dublin
Blair, William	2C	Dundee
Bruce, John G.	2C	Dundee
Cooper, Peter D.	1C	N.Shields
Cuthill, Barry	1C	Dundee
Dickson, Geo. E.	2C	London
Gammon, R. G.	2C	London
Lowe, C. J. M.	1C	Greenock
Macdonald, W.	1C	N Shields
M'Anley, John	1C	Liverpool
M'Dougall, R.F.	2C	N.Shields
Miller, Andrew	1C	Greenock
Milne, Alb. E.	1C	N.Shields
Ogilvie, Wm. G.	1C	Dundee
Olsen, Seren ..	2C	Hull
Oxland, F. W.	1C	Liverpool
Platt, Samuel J.	1C	Liverpool
Purves, Alfred	2C	N Shields
Rewcastle, Alf.	1C	N Shields
Robinson, G. F.	1C	London
Roper, Geo. A.	1C	London
Seymour, Rich.	1C	Dublin
Spittle, Henry S.	1C	N.Shields
Smith, William	2C	Dundee
Wallace. A. A	2C	Liverpool
Wilks, Ewart G.	1C	London

The Marine Engineer

And Naval Architect.

LONDON, MAY 1, 1907.

THE interest attaching to the Colonial Conference and to the visit of the Colonial Premiers is likely to largely overshadow the proceedings of the Navigation Conference, which has been occupied in useful work for the Empire since a little before Easter. Yet the subjects which the Navigation Conference is discussing are full of importance to the Mercantile Marine, whilst many of them are of such a nature as to need prompt handling for the avoidance of difficulties between the Mother Nation and her Daughter States. The situation to be discussed has developed quite recently, and its existence is largely owing to the creation of the Australian Commonwealth. For, as is common knowledge, our Australasian possessions are governed by those who have strong and extended views upon social and economical questions. Their policy is actuated by a desire for the improvement of the condition of their white working population. Britain has undoubtedly the same end in view. But, owing to the complexity of the problems that confront our home politicians, we must perforce move more slowly than they. Accordingly we find that they have passed laws regulating the vessels registered within their borders on lines somewhat different from those which are embodied in the Imperial Merchant Shipping Acts. This they undoubtedly have every right to do. But as mobility is the essence of shipping, it is obvious that where laws are conflicting difficulties and hardships are bound to arise. These difficulties were accentuated when the Commonwealth absorbed the various Australian Colonies, and "coasting voyages" came to include passages from one provincial capital to another. Thus we had the famous case in which the P. & O. Company's officials, their stores having been sealed after their departure from one provincial capital for another, broke the seals as soon as the ship was on the high seas, and got into trouble for doing so when they arrived at the next port. Though our own Board of Trade has devoted much attention to the question of seaworthiness of ships and of accommodation and food scales for seamen, the results of its endeavours have not fallen quite on the same lines as these which have received acceptance in the Far South, and accordingly a vessel which might have been passed as having fulfilled all requirements at a home port or in certain other possessions of the Crown, might yet be put to inconvenience in Australia or New Zealand from the fact that she had failed to comply with the local requirements. It should be understood that the labours of the delegates now present in this country are by no means conclusive of the difficulties of which we have indicated a few. They can only discuss here and advise their respective Governments on their return. Nevertheless that discussion may, and it is hoped will, be productive of much good. For the Conference will teach all those who follow its proceedings of the great need for uniformity in shipping regulations, certainly throughout the Empire, and, if possible, throughout the world. The delegates will return to their respective principals with a desire to show them, even as they themselves have learnt, that it is well worth while for the sake of facility of intercourse and for the avoidance of friction, to make small concessions as to details and to overlook small infringements of regulations, and the probability is that legislation for the purpose of assimilating regulation and practice will follow in the various parts of the Empire concerned.

It may be remarked in closing that some of the resolutions before the Conference may have far-reaching consequences. One of them, which touches on the subject of the employment of British seamen in British ships, may give Australasia the power she seeks to enable her to retain her coasting trade for vessels on the British Register. Another raises the question of the permissible conditions for bills of lading. Its effect might be to limit that freedom of contract which has so long prevailed between ship-owner and cargo-owner, and, in fact, to place our British sea trade under such limitations as those which, under the well-known Harter Act, regulate the working of the American ocean traffic. What the final results of the Conference may be is yet to be seen. But the mere fact that it has been held is undoubtedly for the good of the shipping community, and for the unity of the Empire.

BEFORE the last meeting of the Institution of Naval Architects a paper was read by George Simpson, Esq., on Propeller Struts. This is a subject to which not much attention has been given, and considerable difference as compared with the results obtained from a formula can be seen. In the case of light boats, Destroyers, and even Passenger and Cargo boats a sufficient difference below that given by this formula can be seen, showing that the Propeller Struts are in these cases very nearly at breaking point, whilst in Cruisers and Battleships the other extreme has been reached; in some cases double the amount of metal necessary for these struts has been used, which must show a certain waste of metal. The formula set forth by Mr. Simpson is a semi-empirical formula not dependent for its truth upon any deep-seated calculations, but dependent upon the various factors that serve to effect a breaking load in the struts. This is effected by making a proportional relationship between the area of the arm, the horse power transmitted and the overhang of the struts. There appears to be a difficulty in determining the stresses that are exerted upon these struts, and considering the bracket as a cantilever, would result in giving the greatest section to the arms where they adjoin the shell palm

and tapering thence to the junction with the hub. This has been a usual design when twin screw vessels came into general use, but results have shown that it is centrifugal forces, alternating ones, that, having caused vibration to the outer parts of the arms, have caused the breakage of the struts. The formula suggested by Mr. Simpson is for the area of strut $= \sqrt[3]{\frac{P.R.C.}{\cdot 0633R}}$ where P is the horse power transmitted by the shaft, R is the number of revolutions per minute, and C is the outward length of shaft in inches. The length of the above section is found from $L = \sqrt{5 \cdot 333 \text{ area}}$, whilst the Breadth of the section is practically $\frac{1}{4}$ of its length. It is also pointed out that the sectional area of fastenings of the strut arms through the palms to the shell should be about a half of the area of the strut. Mr. Simpson gives a detailed paper of various types of vessels, from cruisers and battleships to channel steamers, passenger and cargo vessels to destroyers, torpedo boats and pinnaces, and it is there shewn that the formula he gives, brings out a very regular basis for the figures required. Where present results do not agree with this it is to be presumed that the results have not been calculated.

WE must congratulate the Institution of Naval Architects upon the subject of the paper entitled "Cranes for Ship Building Berths," read by Signor Carlo Piaggio, as this paper deals with a practical suggestion as to the fitting up of three berths for building vessels with two lines of four cranes each. The subject of labour-saving appliances in dealing with ship building materials is at present attracting much attention, and the application of these electrically-driven cranes to the Riva works, near Genoa, is well worth attention, as they have been fitted for the last three years, and figures are given as to the cost, their annual expense, taken at 16 per cent., and their relative advantage annually as compared with the now old-fashioned mast or derrick system. The present system has been found to satisfy the following principal requirements: (1) Ability to take materials lying on the ground in any part of the yard near the berths, and to carry them rapidly to the exact position on the vessels being built; (2) moderate first cost, and consequently moderate expense of upkeep; (3) greatly reduced incumbrance; (4) possibility of carrying on work in different parts of the vessel at the same time and independently; (5) possibility of launching vessels with masts and funnels in place. It is only as regards building in Italy that this latter item applies, as it is well known there that this point is generally made use of in Italy. The plant at the Riva works consists of six electric tower cranes of 1·5 tons capacity to each of them. They work on three berths, and another crane has been since added. There are in each crane three 110 volt continuous current motors of the S.E.B. type. One motor of 8·3 H.P. actuates the lifting winch; one of 2·1 H.P. moves the truck along the horizontal jib; and the third of 3·2 H.P. gives the turning movement to the crane. The lifting speed is about 50 ft. per minute, the travelling speed of the load truck is 92 ft. per minute, and the turning speed at the extremity of the jib is 400 ft. per minute. The six cranes are placed in two rows, three upon each side of the central berth, and as near as possible to the side berths. Signor Piaggio recommends an improved scheme for fitting up three berths, in which he recommends as many as eight cranes in two rows, four in each. These would be set on either side of the central berth, with two other berths outside. He recommends improved speeds for these cranes, *viz.*, a lifting speed of 80 ft. per minute, leaving the other speeds practically as before described for the present cranes. These would be fit to deal with ships 460 ft. long, and with corresponding beam. This appears to be a very good scheme, and economical for fixing up the berths for these steamers.

Messrs. Davidson & Co., Ltd., of Belfast, issue a neat catalogue relating to heating and ventilating, which they divide into four principal sections. The first relates to a description of their apparatus generally, the second to the system as applied to industrial buildings, the third to public buildings and the last to ship ventilation. The particular fan the firm put forward, named the Sirocco, is well known. It is shown here both as a centrifugal and as of the propeller type, with the general methods of application as applied to various public buildings, but coming to ships the firm say many difficulties are met with which more often than not entail separate installations in different parts of the vessel. These units are shown exhausting from galleys, lavatories, etc. For forced draught work the system is employed in the stoke holds. The ventilation of cargo spaces for perishable goods is also another field for the employment of fans, which is noticed here, and the book closes with photos of vessels of the navy and mercantile marine fitted by the firm.

Mr. Peter Boyd, R.N.R., has just retired from sea service after thirty-nine years' experience as a marine engineer, all of which has been gained in the service of the British India S. N. Co. Mr. Boyd served his apprenticeship with Messrs. Robertson & Son, Vulcan Engine Works, Leith. After two years' further experience on shore at the Bowershall Engine Works, Leith, and at Tod & McGreggor's works, Glasgow, he joined the British India Co.'s ss.. *Ethiopia* as junior engineer, sailing to India round the Cape in 1868; remaining on the Indian Coast Service, he was promoted to chief in 1871, and served in several steamers, the *Martiban, Karachi, Ethiopia, Punjaub, Canara, Henzada;* in the last two steamers he sailed from London to the East on the home line of the company. He was appointed to the *Taroha* when built, then to the *Dilwara,* in which steamer he served for several years while engaged in the transport service. When the new turbine steamer *Rewa* was built by Messrs. Denny & Co. last year, Mr. Boyd was appointed chief engineer and after a successful season in H.M. transport service, he is retiring upon his laurels and the fruits of his industry. On the occasion of his transfer from the *Dilwara* to the *Rewa,* a presentation was made to him, with the best wishes of those who had served under him and these wishes are added to by his messmates of the *Rewa.* As he has commended himself to many friends and acquaintances both in London and Southampton, these extend warmest wishes towards him on his retirement, that he may now lie back on his oars and enjoy his ease to the fully allotted span. Mr. Boyd is on the Royal Naval Reserve and was a vice-president of the Institute of Marine Engineers, of which he was one of the original members.

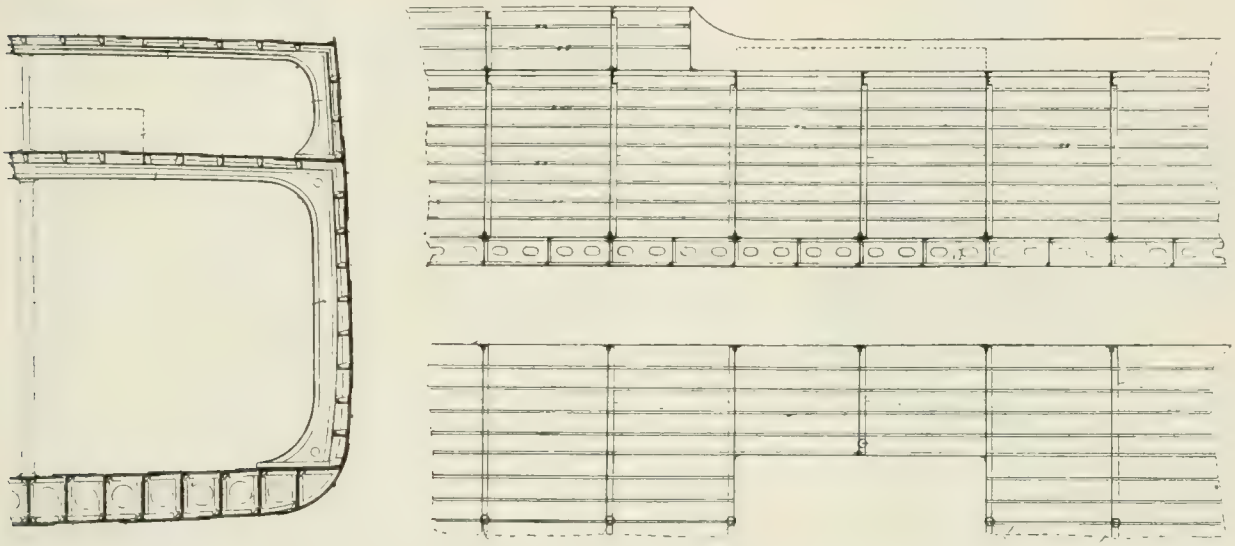
A NEW PRINCIPLE IN SHIP CONSTRUCTION.

THE inventor who wishes to introduce a serious departure from modern practice in shipbuilding must have confidence in himself and his invention, for in almost no other modern applied art is the difficulty of effecting a change so great. Shipowners are, in the main, satisfied with the dividend-earning machines they possess, and have reluctance to embark on risky experiments. The British workman opposes a steady resistance to any departure from recognised methods, indeed, long continuance has crystallized the present method of building ships into a form very difficult totally to change, or even modify.

all authorities are agreed in regarding as the ideal one, *viz.*, the Longitudinal system.

It is a matter of history that many suggestions have been made for framing ships on what has been called, more or less loosely, the longitudinal system. "The Great Eastern" is a famous example of a vessel actually built, but in that case, as in every other, the expense consequent upon the difficulty of obtaining the form of the vessel, and of easily and rapidly attaching the different parts to each other, in addition to the great difficulty of erection, effectually prohibited its employment in the construction of merchant ships. It is the claim of the inventor that he has succeeded in rendering his vessel more easy to construct than even under the present method.

Coming to the design itself it may be well to indicate here some of its more salient features. We

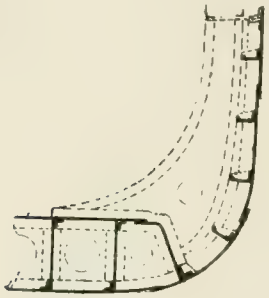


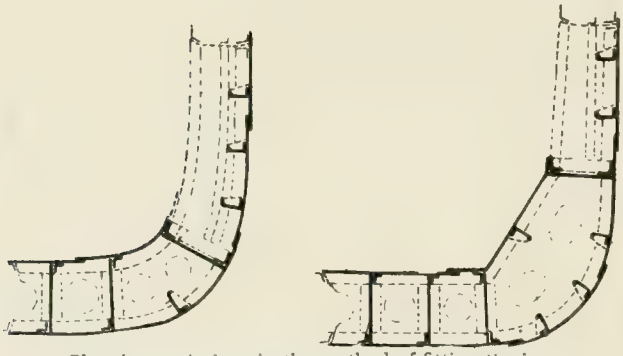
Showing respectively half section, part profile and deck plan of a single decked cargo steamer, fitted with double bottom for water ballast.

But if this is ever to be done, it is the opinion of those well qualified to judge, that an invention, recently patented by Mr. J. W. Isherwood, has every chance of doing so. Mr. Isherwood, who is a Surveyor in the department of the Chief Ship Surveyor to Lloyds' Register—a position he has occupied for a number of years—knows intimately the conditions under which the modern steamer has to work. It follows from the nature of his employment, that he is cognisant of the special weaknesses which have developed, he is familiar with the stresses to be withstood by vessels, and with the problems involved in their cheap and rapid construction. It is evident from the most casual examination of his design, as set forth in the published specification (No. 2588, A.D. 1906), that he has turned his experience to good account, and that he has succeeded in his attempt to render feasible the only system of ship construction which

find that the transverse strength of the vessel is provided for by means of a series of strong transverse frames, with each of which is associated a strong transverse beam, forming a continuous transverse girder, and the inventor lays special stress on the direct connection which exists between these structures and the plating of the shell and deck. These transverse girders are spaced at intervals of 15 to 20 feet, depending on the dimensions, and whether the vessel be fitted with ordinary floors or with a cellular double bottom, provision is made for preserving unimpaired the continuity of these girders. In conjunction with them are fitted a series of longitudinal frames and beams, which may be of any of the usual shipbuilding sections, and which may be arranged to run continuously through the strong transverse frames and beams, or to be cut there and connected to them in the usual manner. These fore

and aft frames are spaced about the same distance apart as the transverse frames of a vessel framed transversely, while the fore and aft beams can be spaced much wider than the frames, say from 30 to 50 ins. The construction of the double bottom will be understood at once from the illustrations which are extracted from the specification. The system can be adapted to any form of tank top, whether the margin plate be fitted in the usual way or the tank top be carried out level to the side or curved up the bilge. The bottom framing, including floors, in vessels with either single or double bottoms, is longitudinal, and, when preferred, can be constructed intercostally between transverse divisions or floors in line with the strong transverse frames already referred





Showing variations in the method of fitting the inner bottom plating in vessels having double bottoms.

to, or, in the case of a vessel with a double bottom, the transverse girder may either be fitted continuously round the bottom, and the tank margin cut, or the transverse frames may be cut and attached to the tank margin. As a concrete example of the application of his system to a ship of very common type, *viz.*, a single deck cargo vessel, Mr. Isherwood suggests the following :—

Dimensions—329·17 × 44·74 × 25·42.

Strong transverse frames—30 × $\frac{9}{20}$, spaced 16′ apart.

" " beams —20 × $\frac{10}{20}$.

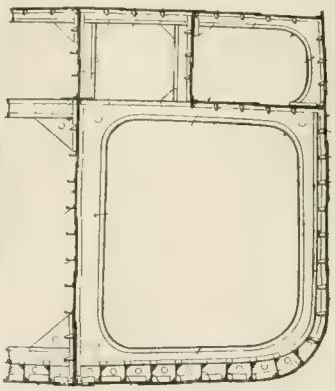
Spacing of fore and aft frames = 28″.

Uppermost frame— 7 × 3½ × $\frac{10}{20}$, bulb angle. } Intermediate frames gratuated between.

Lowest " —12 × 3½ × $\frac{15}{20}$, " }

Fore and aft beams = 7 × 3½ × $\frac{12}{20}$, bulb angle, spaced 33″ apart.

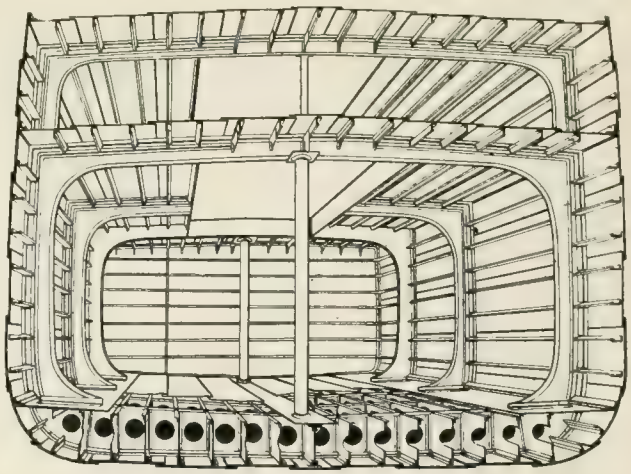
Enough has been said to indicate the main lines upon which the designer has proceeded, and a few remarks on the advantages of the new system may not be out of place. And first as to strength. It has been calculated that the stress upon the



Half section of a vessel designed for carrying petroleum or other liquid in bulk.

Alternative method of fitting the floors in vessels with single bottoms.

transverse frames is less than upon the frames of a vessel built transversely, assuming the same water pressure and the same conditions in the two cases; and in the case of the beams the stresses due to the same weight of cargo are less than in the system now in vogue. The calculation for the tensile strength at the gunwale also reveals the fact that, assuming the same thickness of shell and deck plating in each case, the intensity of stress at that part is reduced by 2½ tons. In these calculations the



Interior of ordinary cargo steamer.

vessel has been compared with a vessel of the same dimensions built on the transverse system to obtain the highest class in Lloyds' Register, and it is evident that no timidity need exist on the score of strength; there appears no reason to doubt that such

a vessel could be made materially stronger, weight for weight, than the existing type. The advantages in construction are equally obvious. The fore and aft beams, which constitute the support of the deck plating, can be prepared and punched ready for placing in the vessel, for they may be fitted in straight lengths even in ships having considerable sheer. The costly processes of bending beams and fitting beam knees are thus dispensed with. The fore and aft frames which constitute the support of the shell plating, can also be fitted in perfectly straight lengths for a great part of the vessel's length, and even at the ends any bending necessary can be done without heating the bars. There should be no difficulty either in erecting this vessel. When the strong transverse frames are erected and faired, the form of the ship is accurately defined, and work may be proceeded with rapidly. Mention may be made of the special adaptability of this type of vessel for the trade of carrying oil in bulk. Each of the bulkheads, which are a necessity in the oil steamer for purposes of sub-division, can be utilised as a strong transverse frame. Full advantage is thus taken of material which *must* be placed in the ship, and in this respect a decided advantage is obtained over steamers framed transversely, and engaged in carrying oil in bulk. The construction, too, is simpler, a multiplicity of brackets is avoided, and considerable weight of material is claimed to be saved.

A point that will interest the underwriter is the fact that this vessel will not be so vulnerable to sinking by collision, and that repairs due to damage from whatever cause can be effected more cheaply and rapidly than at present. If, for example, the bottom of an ordinary vessel be damaged, before a broken floor-plate can be renewed the shell-plating for the whole breadth of the bottom must be cut away; while in the proposed system, owing to the floors being fitted longitudinally, one or two strakes of plating only will be sufficient to remove, unless the damage is very widespread. It is evident also that similar remarks apply to the side framing.

When to these considerations is added this further fact, that the new system admits of a reduction in weight of approximately 100 tons for a cargo vessel of the dimensions given above, and a corresponding gain in carrying capacity and reduction of first cost, it is difficult to resist the impression that this innovation has "come to stay." It is an earnest and workmanlike attempt to realize a greater perfection in the art of shipbuilding, and it may be hoped that such ingenuity will not go unrewarded. The author is an officer of Lloyds' Register, and this, the oldest and strongest of our Registration Associations, is to be congratulated upon the possession of servants of great knowledge and experience, and on one who, in addition, has original ideas and the courage to apply them.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Salvage of the "Suevic."

THE Liverpool Salvage Association has done an exceptionally smart piece of work in the cutting asunder of the great hull of the stranded White Star liner and in getting the floating portion so trimmed and shored at the bulkheads adjoining the cut, as to enable her to make the somewhat lengthy voyage to Southampton. It is a wonderful test of the good workmanship which has made the fame of Queen's Island that the hull stood the strain of the Atlantic seas for so many days, whilst at every tide the leverage of the rise and fall of the floating end of the ship was brought against the fixed portion, striving ever to break her back. Yet the proofs of integrity are apparent, for not only are all the remaining masts truly in line, but the engines worked freely as the ship went round, and the butts of the salved part of the hull showed no signs of weeping. What other tests of soundness can be sought for?

As has probably been noticed by our readers, the ship was inspected by Lord Pirrie and his subordinates almost as soon as she docked. The reports were so favourable

Captain F. G. Cameron, R N R., F.R.G.S., Commodore of the White Star Fleet, and late of the *Oceanic*, who has been appointed Marine Superintendent at Southampton for the White Star and American Lines.

that it was at once determined to build a new forward portion, somewhat longer than that which had been left on the rocks. The new *Suevic*—or whatever her name may be—will thus be of greater length and larger tonnage than the original vessel. At once the work of building the new structure was put in hand at Belfast, whilst the after part of the ship was cleared of wreckage and broken plates and then undocked. Whether the union of the old and of the new parts will be completed at Southampton or at Belfast remains to be seen. It would be curious to know how the cost of this salvage will work out in the company's books. But the nett result will never be allowed to transpire. Nevertheless, regarding previous instances, it may certainly be said that the work and labour expended on the *Milwaukee* was apparently a good investment. That of the more recent case of the Nelson liner *Highland Fling* is more doubtful. For the salved end of the ship, after being brought safely into port was sold by auction and realized no more than £4000. This does not sound like much more than the price of old iron for a ship of her size.

The *Suevic* is not the only Combine ship to have been in trouble of late. Another vessel, the *Darien*, once of the old West India and Pacific Steam Navigation Company, more recently of the Leyland limb of the Combine, has been ashore at the Magdalena river for many weeks. At the end of March it was reported that she lay in 13 ft. of water aft, whilst at the bows there was as little as 7 ft. There seemed to be a difficulty in getting lighters and tugs of draught suitable for the salvage, and eventually a New Orleans tug was requisitioned for the service. There is, by latest reports,

a gale prevailing which it is expected will last about a month, and during that period cause all salvage operations to be suspended, but meanwhile nature is not idle. The ship and the shore on which she lies are said to be moving bodily towards deeper water at the rate of a mile a week. It was thought at the end of March that it would take some months from that time to complete the salvage. But thanks to this shifting of the ground, it is possible that she may be afloat by the end of June—provided, of course, the gale does not seriously damage her in the meanwhile.

The "Berlin."

A lengthy and exhaustive inquiry into the circumstances surrounding the loss of this steamship has been held at Westminster. That the ship was well found and that every one of the crew did his duty hardly needed placing on official record. It is well, however, that the fact that the company had no pecuniary interest in forcing the pace of the ship should be proved, for there have been suggestions that the master had to get his vessel into port to time regardless of weather and sea, in order that the owners might not be put to the expense of special trains on the Dutch side to carry the passengers forward. The suggestion is met with the

Mr. F. J. Blake, R.N.R., recently Assistant Engineer Superintendent to the White Star Line at Liverpool, who has been appointed Superintendent Engineer at Southampton for both the White Star and American Lines.

authoritative statement that if special trains were required, not the Great Eastern Railway, but the Dutch lines would have to bear the expense. Again, it was sought to use the fact that the *Clacton* of the company's cargo service, following the ill-fated *Berlin* into the Hook of Holland, put to sea again, and waited for a time, as evidence that Captain Precious made an error in attempting to negotiate the entrance under the prevailing circumstances. But the master of the *Clacton* gave as his reason for putting about, not the conditions of weather, but the fact that the wreck of the mail steamer so fouled the entrance to the cut as to make it inadvisable in his opinion under the circumstances to attempt to make the passage. Lastly, there were the claims of the inventor of an oil distributing apparatus to a hearing on the ground that his system would have calmed the surrounding waves, and the proposition of a King's Counsel—who appeared for some of the lost passengers' relatives—that deck-seats and deck-house roofs should be separate entities from the hull, each capable of floating away on its own account with a load of distressed persons.

The decision of the Court to the effect that Captain Precious was guilty of an error in judgment in attempting the passage will come as a surprise to seafarers. If he had not attempted the passage the ship need not have been lost. This is obvious. But in view of the facts disclosed at the enquiry one is at a loss to see what reason could be given before the accident to cause a prudent seaman on this occasion only to put out to sea again.

Meanwhile it may be noted that the Great Eastern Company has given an order for a steamer to replace the lost ship, and in doing so has given its adhesion to the turbine principle. As a perhaps necessary sequence to the resolve to leave the reciprocating engine, the company has placed the order for the vessel, not with their old friends Messrs. Earle, of Hull, but with Messrs. John Brown & Co., of Clydebank, who have already achieved so much success with the new type of machinery.

The German Lines

appear to be taking up an even more aggressive policy than heretofore towards our British companies. The remarks of Herr Ballin, both in the report of the Hamburg Company and at the meeting, as well as in his letter to the *Standard*, seemed to show that he resented the continued existence of the Cunard Company, at least as an independent British line, in regard to the passenger trade from North Sea and British ports. At the same time there are rumours of attacks on the Hungarian branch of the Company's trade by that other big German Company, the Nord Deutscher Lloyd as principal, though the Hamburg line is even here assisting. An opposition to the Cunard Fiume and New York service has certainly been organized. There will be fortnightly sailings of vessels under the Hungarian flag by a company whose capital will be to a large extent found by the German lines—the Lloyd contributing 40 per cent. and the Hamburg line 27 per cent. of the needful funds, the remainder being found by other lines.

Then in regard to the West African trade, long the stronghold of the Elder Dempster companies, the Hamburg line

Captain E. J. Smith, Commander R.N., late of the White Star Liner *Baltic*, who has been appointed to the new ship *Adriatic*, which sails on her maiden voyage to New York from Liverpool on May 8th.

is making a move of determined opposition. It held a special meeting of shareholders on the 15th April for the purpose of obtaining powers to increase its capital to £6,250,000 in order to carry out a provisional agreement into which it had entered with the Woermann line for that purpose. The return had already met with the publicly expressed approval of the Kaiser, and needless to remark, the final assent of the shareholders followed as a matter of course. The agreement between the two German companies amounts to this. Shares in the Hamburg Company of the nominal value of a quarter of a million sterling are to be transferred to the Woermann Line at 130 marks a piece, and in exchange eight ships of the latter company are to be handed over to the all-embracing Hamburg-American line, which will thereupon begin forcing the competition to the West Coast of Africa. There will soon be no trade to which the tentacles of this huge organization do not spread.

The Turbine-Engined Liner.

I have already remarked in these notes on the order just placed by the Great Eastern Railway with Messrs. John Brown & Co., of Clydebank, for a cross-Channel steamer, engined on the turbine principle. Meanwhile the South-

Eastern and Chatham is increasing the number of its up-to-date vessels. A new *Victoria* was added to its fleet in March, to be followed in April by the launch of a sister vessel named the *Empress*. The company will thus be in possession shortly of no less than five vessels of the turbine type.

The Cunard Company in their annual report refer to their experience of the new steamship *Carmania* as proving the suitability of the turbine engine for the Atlantic passenger trade. This testimonial, though couched in restrained language, is sufficient to make one feel assured that the success of the *Mauritania* and *Lusitania*, which are to be ready for their trials in three or four months, will at least equal the expectations of their builders.

Meanwhile we have the announcement that the Hamburg-American Company has ordered a duplicate of their small steamship *Kaiser*, with which they have been testing the turbine principle in their home waters.

The Battle of the Ports.

Southampton has now received her first White Star liner, for we must not reckon the *Suevic*—in the *Celtic*, which arrived from New York on the evening of the 15th April. She is not at present quite representing her own flag, for she has taken the place for a voyage or two of the American liner *St. Paul*, which for some little time has been off the station to receive new boilers. Up to now an Atlantic Transport liner has been considered adequate to fill her place. But as the passenger season advanced it was found necessary to substitute a ship of greater accommodation. The present season, indeed, promises to break the record in Atlantic passenger business, as it is said that no less than a quarter of a million of American tourists are preparing for a peaceful invasion of Europe.

The question which has agitated men's minds in Liverpool and Southampton—and indeed elsewhere—has been whether the Cunard Company is likely to follow the White Star Line to the Solent. On this point the report was silent, whilst at the annual meeting of the company held on the 18th April the chairman would make no definite pronouncement. But that the new vessels are likely to make Liverpool their head-quarters, at least for some time, seems clear enough from the action of the Mersey Dock and Harbour Board, who are likely to be in touch with the management of the premier Atlantic Company. Two things are noticeable. First, that the new dredger the *Centaur* is engaged in the work of deepening the ocean berths at the Prince's Landing Stage in order to enable vessels drawing 4 ft. more than those at present frequenting it. Second, that in consequence of the great height of the decks of the new vessels there is an anticipation of difficulty in the use of the present baggage transporter at the berth, and measures are to be taken to meet the situation. Southampton in its turn, though it will not face the expenditure necessary for the fulfilment of the desire of the White Star Line for a straightened 35 ft. channel, is preparing to consider the advisability of dredging to 32 ft. at low water spring tides, though it still hopes to get assistance in doing so from the London and South-Western Railway.

The Cunard Line

have issued a *Pictorial History*, 1840-1907, which should be of great interest at the present juncture. It gives coloured illustrations of many of its famous liners from the pioneer ship *Britannia* through the *Persia* and the *Scotia* to the leviathans now completing at Wallsend and Clydebank. Many well-remembered names are included in the list. One might almost characterise the book as illustrations of the development of deck structures, as one looks at the earlier flush decked vessels and passes on to the modern steamers with their three or four tiers of deck houses. A short, crisp description accompanies each picture, and an interesting diagram is appended to trace the development in dimensions for the 200 ft. *Britannia* to the 780 ft. *Mauretania*.

Whilst dealing with the Cunard Company it is well to notice the exceedingly satisfactory report for the year 1906, which the directors were able to lay before the shareholders at the annual meeting in April. This is the best possible answer to the ill-based anonymous attacks for which a certain daily shipping paper thought fit to allow prominence in its columns last year. Gross earnings are about half a million higher than they were in the previous year, which itself showed a better record by a full quarter of a million than its predecessor. On the other hand, working expenses are also considerably higher, owing to the employment of the numerous large steamers which have of late been added to the fleet. But in spite of this the gross profit is £557,000 against £315,000 the previous year, enabling the board to place a sum of £120,000 to the credit of the insurance fund (on which owing to Cunard care, the claims have been of the slightest) against nothing last year. Further, £50,000 goes to reserve as last year, and £210,000 is placed to depreciation as against £175,600 last year. Lastly, to come to the point which shareholders are apt to consider first, the dividend is raised 1 per cent., and the substantial sum of £54,400 is carried forward to the now current account. This shows 1906 to have been the best year in the company's history from the financial point of view, and seems to justify abundantly the policy of the board in building vessels of the *Caronia* and *Carmania* type. It is also, we may hope, an indication of financial success for the two fast steamers so soon to come on to the station. Finally, it may be well to remark that from the accounts it appears that already a sum just exceeding 1½ millions sterling has been paid to the shipbuilders on account of these costly additions to the fleet, which we hope soon to see earning fame and money for their owners.

The Port of London.

Every one, who has the real interests of the port of London at heart, and who has any knowledge of the gross want of facilities which characterizes it in comparsion with every other important centre in the world, will be sorry indeed to learn that the subject of legislation in regard to it is hung by the Government for another twelve months. It must be admitted that it would have been impossible for the Board of Trade to have accepted the provisions of the bill promoted by the London and Indian Docks, cleverly designed as it was to make the public pay a fancy price for docks which are too old-fashioned, and too out of date generally, to be capable of being made equal to exacting modern requirements, save at ruinous further expenditure. Although London still maintains her boast of being the greatest seaport in the world, there is, to quote the words of the *Times*, no dock, either wet or dry, on the Thames which can take either the largest liners or the largest battleships, or anything approaching them. Further, it must be remembered that, after years of sloth, and after being denounced by a Royal Commission in no measured terms, the Conservancy in 1905 at last roused itself to action so far as to get a bill to enable it to raise a sum of £400,000 to dredge a 30 ft. channel. Work is beginning on this scheme. But whilst London has been settling to work, other ports are going ahead and soon 40 ft. will be the standard instead of 30 ft. The whole position is deplorable.

THE SCREW PROPELLER.

X.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

THE power of a screw, that is, its ability to produce thrust, depends on its diameter, the area of the acting surface of the blades, and on the pitch ratio, the latter being taken as expressing the angle of the blades.

The column of water projected by the screw will vary as the square of the diameter, whether that column be greater or less in diameter than the instrument itself. The solidity of the column, or the quantity of water passing through the screw, will depend on the extent of the blades, and will increase with each increment of blade area until the column is "solid," after which no increase of thrust will follow an increase in area.

The finer the angle of the screw the more intense will the thrust be; in fact, the thrust will vary roughly

* For Articles I. to IX. see August to April issues.

inversely as the *tangent* of the angle. Now the tangent of the angle of a screw at any diameter D will be pitch $\div \pi$ D, or $0{\cdot}32 \frac{P}{D}$, which is $0{\cdot}32 \times$ pitch ratio. The length of the column = pitch $\times$ revolution per second, and the slip or motion imparted to the water is some fraction of the pitch $\times$ revolutions. Now, if this latter (P $\times$ Revolutions) be expressed as S, then the thrust is some function of the three features and the *speed*, but roughly might be taken as follows, *viz.*:—

$$\text{Thrust} = \frac{D^2 \times S^2}{R} \times C \quad (v. \text{ page } 280).$$

But this expression takes no cognisance of the number, size, or shape of the blades, whereas it is more than probable that the actual difference in thrust of two propellers whose area of blade differs, but otherwise they are alike, will be quite marked; also that if the area is the same, but divided among three blades in one case and two in the other, there will be some difference in the thrust. Further, if there be the same diameter, pitch, number of blades and area of surface mathematical treatment; but very little, if any, practical help was thereby given to those who had to make ships go their best with the least expenditure of fuel. The Admiralty very properly instituted a series of practical experiments to determine which of many screws was the best, as also to ascertain the actual effect of variations in diameter, pitch, surface and shape of blades.

Unfortunately the instruments with which they measured and gauged were apparently imperfect and inadequate, as the results are in many cases irreconcilable and in some absolutely contradictory; sufficient care seems never to have been taken in the choice of weather and tide to avoid their action so affecting the performance as to cause discrepancies. Their measured mile was often in a tide-way and where at low water it was shallow. Even at Stokes Bay, which was the best test place they had, the double tides of the Solent interfere largely in the accuracy of mean speed. The magnificent and unrivalled course of Skelmorlie on the Clyde was then unknown for such a

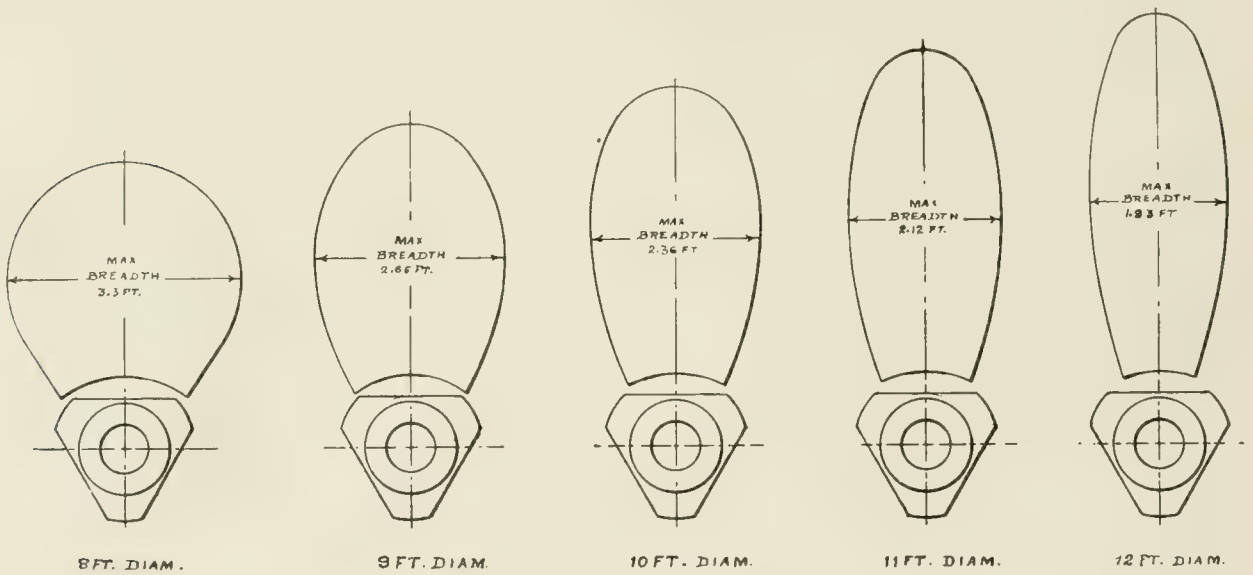


Fig. 20.—Propeller blades of same area for propellers varying from 8-12 feet diameter, 15 feet pitch. Surface 2559 ft.

in two screws, but one is a "common" screw and the other a Griffiths, the results will not be the same. In this latter case the common screw will give the greatest thrust if the ratio of blade area to disc area is large; but it will be accompanied by much more vibration than would be experienced with the Griffiths, and, further, it would require much more power to drive it; in fact, the surface friction and the edge resistance of a common screw is about double that of a Griffiths of the same diameter and blade surface.

The theoretical thrust of a screw can, of course, be calculated, but as found in practice, with so many surrounding disturbing factors, any calculation that could claim respect would be so complicated as to be beyond most people to understand; and to perform would be within the power of fewer still.

In the early days of the screw propeller there were not wanting professors and even engineers who bravely tackled all questions involved in screw performance, and did their best to compel them to submit to the purpose, and even had it come under their Lordships' notice, it was too far away from H. M. Dockyards to send ships for trial. In fact in those days, as now, most of the trials were not intended for scientific purposes, but rather to demonstrate the ability of the engines to indicate the power the engine-builder had contracted for, and that the machinery worked satisfactorily for the few hours taken in making, at most, ten trips past the measured mile.

The *Macnaught Indicator*, used in those early days, was a primitive affair and did not inspire one with much confidence as a scientific instrument by which power developed could be accurately computed. An old writer on engineering expressed the opinion that the deficiencies of the indicator and its gear were such that the diagram, as actually taken, really represented the useful work given off by the engine and not the gross power developed in the cylinder. Now, as in those days it was generally considered that the mechanical losses due to friction, etc., the

working of the pumps, etc., amounted to 25% of the gross power, it would appear as if the efficiency of that indicator was only 0·75. Fortunately some of the early experiments were made with ships having geared engines, so that the engine shaft ran less than 30 revolutions per minute, consequently the errors in the indicator diagram that arise from rapidity of oscillation, especially with such an indicator, would not be observable and so would not seriously affect the result of calculation based on the Indicated Horse Power. In modern times, however, the most serious discrepancy in the indicator diagram arises from the smallness of the pipes leading from the cylinder ends to the indicator cock; when the number of reciprocations of the piston is high, the shortage of mean pressure may amount to as much as 10 per cent. With these slow moving geared engines there should be no such serious loss as this, even when the pipes were long; still, for this latter reason, there doubtless was some loss.

The *Dynamometer* used to register the thrust on the screw shaft was probably a more crude instrument than the indicator, and further, the method of estimating the mean thrust, from a zigzag line, such as produced by it, was open to grave errors. Moreover, experience with such tests in modern times has shown that the utmost care is necessary in the application of this kind of instrument to avoid error, and as much care and attention to the registration of it, to avoid faulty observation and consequent untrustworthy results. In the case of the "Rattler," the thrust, as given by the dynamometer, is inconsistent with the indicated horse power of the engine, especially at the low speeds; but in her case the method of ascertaining the mean speed of the ship was rough, and was probably faulty too. The relation of thrust horse power to indicated horse power, in her case is, however, so high (70 to 78 per cent.) as to lead one to suppose that the indicated horse power was too low and the thrust too high.

Measured mile tests were not always taken with the care necessary for scientific investigation, and none of the available measured courses were free from most serious defects. The Nore or Maplin is in a strong tideway with shallow water. Plymouth was in the open sea outside the breakwater, with no posts or marks of its own specially set down, observations were made of the beacons and lighthouse on the breakwater with marks on Plymouth Hoe three miles away. The best one was undoubtedly at Stokes Bay in the Solent; but even here there is the double tide and comparatively shallow water, which, while being unimportant when the highest speed was twelve knots, became a serious factor when sixteen to twenty knots was common.

A course for trials should have deep water and no tides—a small current running one way does not matter—and sheltered from high winds, so that the effect of the masts and spars, rigging, etc., boats and deck houses is reduced to a minimum, as well as to prevent waves, etc., from forming, which would affect the steering, and add to hull resistance. The nearest approach to this is at Skelmorlie, in Wemyss Bay, in the Firth of Clyde. Trials made there may therefore be depended on as giving results approaching to scientific accuracy. If a series of runs are made in a tideway, the mean speed as calculated by taking the mean of means, or any other way, is often very seriously erroneous, however carefully the observations have been taken. Suppose, for example, a ship is to be tried on a measured mile, where the velocity of the current varies from three miles per hour South to three miles per hour North; that is, the flood tide and the ebb tide attain a maximum velocity of three miles per hour. Suppose the real speed of the ship through the water to be 10·0 knots, and she makes twelve runs at full speed, running a mile off at each end to turn and acquire headway, and she commences to run at twelve o'clock, low water being at one o'clock. She will be on the mile at intervals of twenty-four minutes, and run the first mile *with* the last of the ebb at a velocity of 0·48 knots, and the second run against "a grain" of ebb 0·12 knots; the third will be run at dead low water, and the next with a flow of 0·12 knots, and so on, so that the last two runs are done with the tide nearly at its maximum rate of flow.

TABLE XVI.

Effect of variation of diameter of a Screw Propeller.

Hypothetical Ships.	ss. A.	ss. B.	ss. C.	ss. D.	ss. E
Diameter of Screw	8·00	9·0	10·0	11·0	12·0
Pitch do. do.	15·0	15·0	15·0	15·0	15·0
Area of Black Surface ..... sq. ft.	25·0	25·0	25·0	25·0	25·0
Pitch Ratio	1·875	1·667	1·500	1·363	1·250
Surface do.	0·500	0·393	0·318	0·263	0·221
Revolutions per minute	100·0	97·0	94·0	91·0	88·0
Speed of Ship	12·0	12·0	12·0	12·0	12·0
Calculated Thrust ..... lbs.	6650	7880	9209	10466	11610
Indicated do. ..... ,,	6490	8000	9620	11324	12975
Horse Power delivered by Screw	244·0	290·6	339·3	385·5	427·7
Horse Power Frictional Resistance of Screw	11·6	14·0	16·6	18·9	21·2
Horse Power Frictional Resistance of Engines	40·0	48·0	55·0	64·0	70·0
Total I.H.P.	295·0	352·6	410·9	468·4	518·9
Prop. H.P. ÷ I.H.P.	0·827	0·823	0·823	0·827	0·823
Prop. Thrust ÷ I Thrust	1·050	0·985	0·958	0·924	0·899

The speeds are as follows:—10·46, 9·88, 10·0, 10·12, 9·52, 11·05, 8·32, 12·28, 7·25, 12·97, 7·03, 12·75 knots per hour.

Now the mean of the first five runs, calculated on the principle of the "mean of means," gives 10·0 knots, which, of course, is correct; after that none of the sets of five consecutive runs gives ten knots exactly, but as follows:—9·983, 9·945, 9·998, 10·001, 9·998, 9·990, 9·998. This is the nearest to accuracy possible, for if the ship from one cause or another sometimes took half-an-hour to regain her position, and at another time only twenty minutes, the results would vary much more than the above.

EXPERIMENTS WITH DR. SCHLICK'S GYROSCOPIC APPARATUS FOR STEADYING SHIPS.*

(*Continued from page* 343).

By Sir William H. White, K.C.B., F.R.S., LL.D., D.Sc., Honorary Vice-President.

The first experiments with the *See-bar* were made when the vessel was moored. The gyroscope worked satisfactorily; no vibration or shock was observable, and the arrangements for breaking proved efficient. The revolutions per minute of the gyroscope were raised as high as 3,000 without any bad effects.

Still-water rolling experiments were undertaken next, the motion being produced by running the crew from side to side in the usual manner. With the gyroscope fixed the period of a complete double roll was found to be 4·136 seconds. When the fly-wheel was running at 1,600 revolutions per minute the corresponding period of oscillation was found to be 6 seconds—an increase of 45 per cent. Owing to the small size of the vessel and her deck erections, athwartship movements of men were difficult, and the extreme angle of heel attained was small. It was, therefore, decided to determine the curve of declining angles by starting the vessel from greater angles of inclination, and noting successive angles of heel. For this purpose the chain from a crane was made fast at one side of the boat and fitted with a slip-hook. The boat was then hove over to an inclination of 10° to 15° from the vertical, the chain was suddenly let go, and successive extreme inclinations were noted until they fell to about ½°. The angles of inclination reached in successive rolls were determined by means of a heavy-rimmed fly-wheel, about 2 ft. in diameter, the axis of which was fixed horizontally and longitudinally in the vessel at the height of her centre of gravity. Ball bearings were used to diminish frictional resistance to rotation. The centre of gravity of the wheel was a very small distance below the axis; the period of oscillation was about 20 seconds. A scale of degrees was marked on the periphery of the wheel, and in this way extreme angles of oscillation could be readily noted. This pendulum wheel is identical in principle with that used in Mr. W. Froude's instrument for automatically recording rolling motions.

The results of still-water rolling experiments are recorded in Fig. 3; they strikingly illustrate the enormous extinctive effect of the gyroscope. Comparing, for example, the first and third experiments, where the initial angle of inclination was 10°, it will be seen that with the gyroscope at rest 20 single oscillations took place before the extreme inclination to the vertical was reduced to half a degree; whereas the same amount of extinction was obtained with little more than two single oscillations when the gyroscope was free to oscillate, and the fly-wheel was rotating at 1,600 revolutions per minute. In experiments 2 and 4 the initial angle was 13° 40′, 25 single oscillations were required to limit the inclination to half a degree from the vertical when the gyroscope was at rest; whereas only a little more than three oscillations sufficed when the gyroscope was free and the fly-wheel was running at 1,600 revolutions. It may be added that care was taken in conducting these experiments to avoid any reflex wave-action on the rolling boat. The crane used was fixed on a pile-work mooring stage at a considerable distance from the bank of the river and not near a quay.

Turning to trials made in a sea-way, it is proper to remark that on many occasions experiments were attempted when the conditions resembled those which I personally encountered. Either by the rapid falling away of the wind or other circumstances a sufficiently rough sea was not met with to give conclusive results. As a consequence much time and patience had to be bestowed on the experiments before the full extinctive value of the gyroscope could be obtained, and this fact makes our indebtedness to Dr. Schlick the greater for persisting with the trials until definite conclusions had been reached.

The results of sea trials made on July 17 and August 21, 1906, on the lower Elbe, and off Cuxhaven, are graphically recorded in Fig. 4. The points marked B in the diagrams correspond with the times when the brake band was released—the gyroscopic wheel then became free to swing on its trunnions, and the extinctive forces came into operation. It will be noted that in all cases the practical effect was to extinguish the rolling motion almost immediately. In other words, with the gyroscope free to oscillate and with a rotation of 1,600 revolutions per minute, the *See-bar* was practically deprived of rolling motion, and simply subjected to heaving motions as successive waves passed her as she lay broadside on to the sea. The inclinations on each side of the vertical under the circumstances were insignificant, varying about half a degree to one degree.

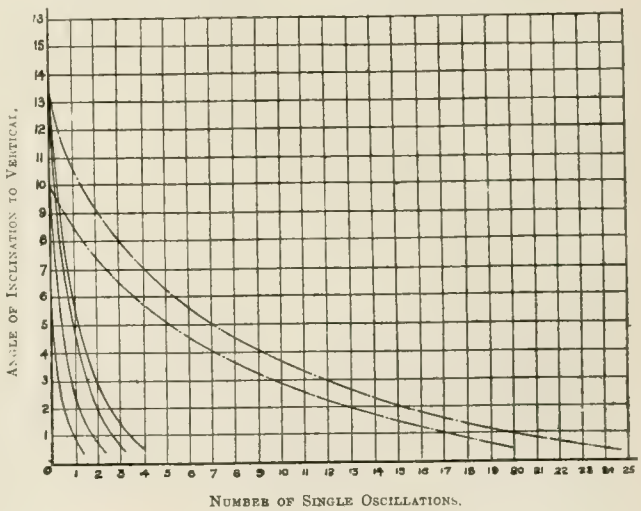


Fig 3

It is interesting to remark that many seamen, to whom the possibility of steadying ships by means of gyroscopes and other appliances has been explained, have expressed the opinion that, if that result could be achieved, it would involve great danger of the sea breaking on board a vessel of which the deck remained practically horizontal. Dr. Schlick himself at an early stage in his inquiry consulted me on this point. I then expressed the opinion that no danger whatever would arise. Indeed it seemed obvious to me that when a vessel rolls heavily, in all probability the risk of seas coming on board would be greater than that in a vessel for which the rolling motion has been destroyed. In both cases vertical heaving motion must take place amongst relatively large waves or the ship would be overwhelmed; but in the ship whose deck remains practically horizontal during the heaving motion the risks of seas breaking on board should be less than in the same ship if her heaving is combined with heavy rolling. Of course, in a ship of relatively very short period in proportion to the wave-period the deck may remain practically parallel to the wave-slope throughout the rolling motion, and consequently little water may be shipped on deck. This actually happened to the American monitors which made long ocean passages about 40 years ago. But

* Read at the Spring Meetings of the Forty-eighth Session of the Institution of Naval Architects, March 22, 1907.

in such exceptional cases the amount of rolling was considerable, and these are not average or representative conditions. The *See-bar* trials show that the fancied danger does not exist, and Dr. Schlick in describing her motion, when the gyroscope was in action and she was placed broadside on to the waves, used the following words :—" The waves seemed to disappear under her, and, as was to be expected, she rose with a gentle motion vertically upwards, and sank again just as gently into the trough of the sea without even spray coming on board to any extent worth mentioning." His description corresponds exactly with that given by other observers of the behaviour of ships of long natural period when exposed to wave-action. Those who have studied the subject will recognise that similar statements were made forty years ago in regard to ships like the *Inconstant* and *Hercules* of the Royal Navy. In later years similar descriptions have been given of the behaviour of the great Atlantic liners, especially those of the " intermediate " type.

Turning back to the diagrams in Fig. 4, it will be seen that on July 17, 1906, the *See-bar*, when broadside on to the sea, *with gyroscope fixed*, reached a maximum inclination of 25° to leeward and 15° to windward. Her rolling motion passed through " phases " gradually increasing and then decreasing. Not long before the gyroscope was set free, the rolling attained 15° on each side of the vertical—an arc of rolling of 30°. Immediately the gyroscope came into operation the arc of rolling (out to out) was reduced to 1°.

On August 21 the corresponding figures were—Maximum inclination attained 13° to 14° from the vertical with gyroscope fixed ; maximum inclination not long before gyroscope was set free 11° to 12°, arc of rolling 23° ; arc of rolling with gyroscope oscillating 1°. A second set of observations on the same day gave maximum inclination 15° on each side of vertical with *gyroscope fixed*, arc of rolling 30° ; with *gyroscope oscillating*, the arc was reduced to 1° to 1½°.

In his paper of 1904, Dr. Schlick gave a formula obtained by Professor Föppel, by which the approximate extinctive effect of a gyroscope may be estimated for a ship assumed to be performing a given arc of rolling oscillation with the gyroscope fixed. This formula may be stated in the following form :—

$$J \cdot \omega = \tfrac{1}{2} \phi \sqrt{D \cdot h \cdot \theta}$$

Where—

- D = displacement of ship in pounds.
- h = metacentric height in feet.
- J = moment of inertia of the fly-wheel.
- θ = moment of inertia of the ship about a horizontal longitudinal axis passing through the centre of gravity. } in foot-lbs. seconds.
- ω = the angular velocity of the fly-wheel.
- ϕ (circular measure) = extreme angle of inclination to vertical attained by ship when rolling with gyroscope fixed.

For the *See-bar* this gives a value of $\phi = \cdot 479$, or an extreme inclination of $27\frac{1}{2}°$ to the vertical, which the gyroscopic apparatus should be capable of extinguishing when set free. It is interesting to compare this estimate with the observations made at sea and recorded above. It will be noted, of course, that the formula takes no account of water-resistance to rolling. Further experience will add to the data required for designing the most efficient gyroscopes for ships of various types and periods of oscillation ; but, as a first approximation Professor Föppel's solution of an extremely difficult problem is evidently one which may be adopted by designers. The practical points in the design of fly-wheels capable of a high rate of rotation, without distress to the material or undue heating from frictional resistances, are being carefully considered, and many improvements can already be made as the result of the *See-bar* trials.

The gyroscope fitted in the *See-bar* was intentionally made relatively powerful for purposes of experimental illustration. The proportion of the weight of the fly-wheel in that case to the total weight of the *See-bar* was as 1 to 114. The proportion of the moment of inertia of the fly-wheel to the moment of inertia of the whole boat, about a horizontal longitudinal axis passing through the centre of gravity, was approximately as 1 to 1,156. In order to obtain experimental data which should be of value in further designs of gyroscopes, it was decided to make an experiment with the *See-bar* with the fly-wheel running at less rates of revolution than 1,600 per minute. When the revolutions were reduced to 1,200, no sensible difference was observed in the steadying effect ; at 1,000 revolutions per minute, a slight reduction in the steadying effect was remarked. At 800 revolutions, under conditions when inclinations of 12° on each side of the vertical were observed with the *gyroscope fixed*, rolling was reduced to 3° on each side of the vertical when the gyroscope was free to oscillate. This last trial showed that when the moment of inertia of the fly-wheel was only *one-fourth* of that provided for in the design of the gyroscope of the *See-bar*, a considerable reduction in rolling was produced. It has been stated above that the number of revolutions of the gyroscope fitted in the *See-bar* were raised to 3,000 per minute in the preliminary trials, and that no bad results followed. Experience with the wheels of steam turbines also shows that it is possible to work at much higher peripheral velocities, provided suitable designs and materials are adopted. With a peripheral velocity twice as great as that used on the *See-bar* the same effect could be obtained with a fly-wheel of 2·3 ft. diameter as was obtained when the actual fly-wheel fitted ran at 1,600 revolutions per minute ; and it is evident from the trials made at reduced rates of revolution that a wheel of only 2 ft. in diameter would have given as great a steadying

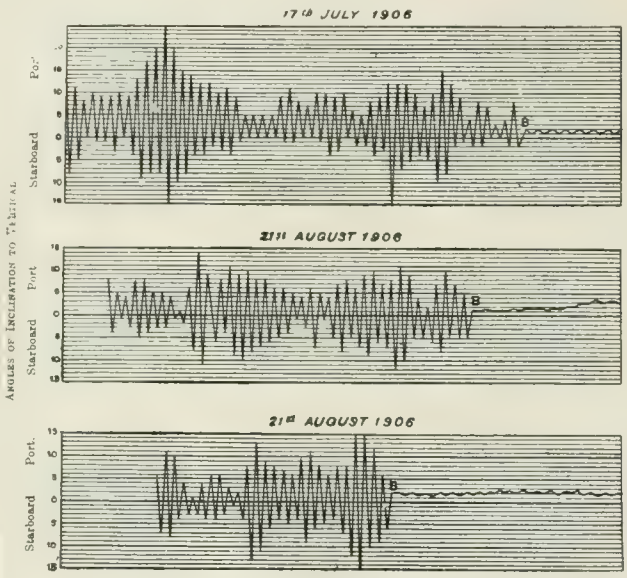


Fig. 4.

power as was required in practice. These facts are of great importance in considering possible applications of the system to larger vessels. Such installations would include electric driving as well as improvements in lubrication and in the design of the brakes. Dr. Schlick has already done much work in these directions ; he is convinced that the system may be applied to larger vessels in forms that would secure considerable steadying power, while the requirements for weight, space and motive power would be kept within such moderate limits that they could be accepted by shipowners.

In regard to the extended use of gyroscopic steadying apparatus in sea-going ships of considerable size, there is room, no doubt, for differences of opinion, which will only be determined by further experience and experiment. The *See-bar* is a small vessel, but the scale of the experiments therein made is sufficient to indicate great possibilities for the system, and we owe much to Dr. Schlick and those who have assisted him by having carried the investigation so far. Dr. Schlick desires especially to acknowledge help given by the authorities of the Hamburg-Amerika Line, the Vulcan Company, of Stettin, and Messrs. H. Stulcken's Son. The members of the Institution, will I am confident, congratulate Dr. Schlick and our other German colleagues in the profession on the completion of so excellent a piece of experimental work.

My own opinion in regard to the extended use of gyroscopes on shipboard may be briefly stated. It will be wise, I think, to proceed gradually, and to begin with yachts and passenger steamers employed on coasting and cross-channel services. Two years ago I considered the question for the turbine steam yacht *Albion*, of about 1,300 tons T.Y.M., which I designed for Sir George Newnes, and it was arranged to make an experiment on board that vessel when the *See-bar* trials were concluded. Unfortunately, a considerable time has been necessarily occupied on these trials, and this prevented us from carrying out the intended programme in the *Albion*. I am confident, however, that in modern steam yachts, all of which have electric installations, it would be possible to obtain great steadiness at sea by means of gyroscopes of moderate size and weight which could be fitted without difficulty and without inconvenience of any kind.

Cross-channel and coasting passenger steamers of high speed are another class in which the steadying effect of gyroscopes would be of great advantage, and where there would be no difficulty in regard to space, weight, or electric driving. I have investigated this problem for typical vessels now on service, and feel confident that remarkable steadiness could be assured by the installation of gyroscopes of moderate size and weight requiring comparatively small power for driving them. The designs for such gyroscopes have been considered; and the Hamburg-Amerika Company have decided to make a trial of the system in a passenger steamer running between Hamburg and the pleasure resorts off the German coast. There are many routes traversed by passenger steamers belonging to the United Kingdom where considerable seas must be encountered, and for these vessels it is certain from the results attained in the *See-bar* that greatly reduced rolling might be secured by means of gyroscopes.

For ocean-going passenger steamers it is possible that gyroscopic steadying apparatus may be introduced hereafter. One must recognise, however, that these vessels are remarkably steady at sea under most circumstances, because of their large dimensions and long periods of oscillation. In them, therefore, the advantages of gyroscopes would be less important than in smaller vessels; but the experiments herein described show conclusively that gyroscopes could be designed within permissible limits of size and weight which would exercise a sensible steadying effect upon even the largest passenger steamers on service.

For warships the possible applications of gyroscopes are numerous, and the advantages of a steady gun platform are great. It may be anticipated that experiments will be made before long with gyroscopic apparatus in destroyers and in the smaller classes of cruisers. For large war vessels the tendency of late has been to accept much greater metacentric heights than were formerly accepted, in order to favour range of stability and to provide a larger margin of safety against damage in action. These modifications, of course, tend to shorten periods of oscillation, and to increase frequency of rolling in a sea way. On the other hand, greater beam carries with it a reduction in the angle of effective wave-slope, and the underwater forms adopted probably tend to increase resistance to rolling. Experience will prove whether, on the whole, these recent types are inferior in steadiness to preceding types. Should it prove to be so, it will undoubtedly be possible to secure greater steadiness of gun platform by means of gyroscopic apparatus, although it is obvious that the great moments of inertia and large metacentric heights would necessitate the installation of large and powerful gyroscopes to secure adequate extinctive power. All these questions will be dealt with in due time by responsible designers.

For present purposes it is only necessary to say, in conclusion, that Dr. Schlick's system opens up possibilities for the future in regard to controlling the rolling motion of ships at sea which have not been approached hitherto. There have been many previous workers in this field of inquiry, whose investigations will always command respect. Mr. William Froude laid down the principles of the behaviour of ships at sea in a form that has guided naval architects in all subsequent work. Professor Rankine did much original investigation of a similar character. For many types of ships, however, it is not possible to secure a sufficiently long period of oscillation to ensure general steadiness and freedom from heavy rolling under ordinary conditions at sea. Sir John Thornycroft devised a beautiful automatic steadying apparatus, and applied it practically to his yacht (see Transactions I.N.A. for 1892). The use of bilge-keels and water chambers as means of steadying ships have been fully discussed at meetings of the Institution. Our Transactions contain practically a complete collection of papers dealing with these important subjects. In the present contribution, I have attempted simply to describe the latest addition to our knowledge made by Dr. Schlick as the result of long-continued investigation and experiment. We should have preferred that Dr. Schlick himself should have undertaken the task; but, as he could not do so, I venture to hope that the work done on his behalf may have permanent interest and value as recorded in the Transactions.

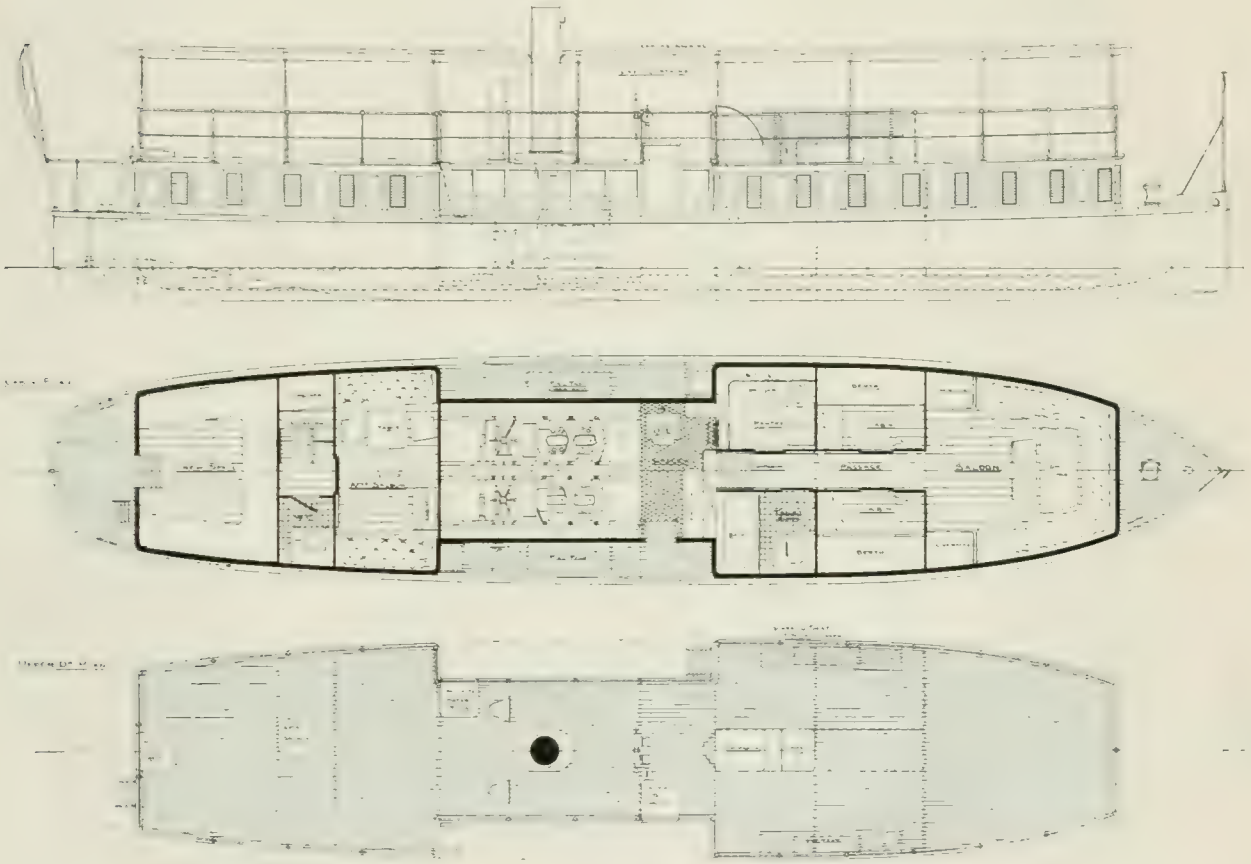
NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondents.)

Portsmouth Dockyard.

THE *Dreadnought* arrived in time to give Easter leave to her crew. She left Trinidad at midnight on March 17th, and arrived here at 7.45 p.m. on the 27th, the voyage giving a speed of about 16½ knots. It is understood that the ship has come through all the numerous trials which have been carried out since her departure from England in the most satisfactory manner. The cruise was marred by two mishaps. When five days out from Trinidad a tube burst, three men being seriously scalded. The damage was repaired within two days. The other mishap occurred during the earlier portion of the voyage in Aranci Bay. It was not attended by any personal injuries, but the damage to the boiler tubes could not be repaired on board, and the work has been done here. The gunnery officers were delighted with the vessel's performance, for the discharge of a full or half broadside did not have the least effect on the structure. Nor could anything have been more satisfactory than the working of the turbines. Work on the *Bellerophon* is proceeding apace. The supply of building material has been such that there has been no delay whatever in the construction of the vessel, and between three and four thousand tons of material have now been worked in. There has been a great deal of work lately in connection with the destroyers, as most of those belonging to the Reserve Flotilla have been taken in hand for overhaul, and in some cases the repairs were extensive. The sea-going flotilla has also been overhauled. All scouts, destroyers and torpedo boats have now to be docked at least twice a year, and as there are nearly a hundred of these craft attached to the port, it follows that all the smaller docks are generally occupied. The extension of No. 15 Dock is making satisfactory progress. An additional 50 feet is being added, and the dock will then be 610 feet long and 94 feet wide at the entrance. It will, therefore, be able to take vessels much larger than the *Dreadnought*. The Royal yacht *Osborne* has gone to Glasgow in order that her principal fittings may be turned over to the new yacht *Alexandra*, which is to be launched on April 30th. The King and Queen have many personal articles and nicknacks on board which they are desirous of retaining, and these, with the best of the furniture, are to be placed on board the *Alexandra*. The fittings of the King's smoking room are also to be removed to the new yacht, after which the *Osborne* is to be broken up. Much interest was taken in the three Russian ships which visited this port, for two of them, the *Tsarevitch* and *Bogatyr*, took part in the late war. The other was the battleship *Slava*. It is interesting to note that in June we are to receive a visit from two Japanese vessels, the *Tsukuba* and *Chitose*, both of which figured conspicuously in the war. The vessels are now at Jamestown, in connection with the opening of the exhibition there by President Roosevelt. Up to the time of writing, nothing very much is known as to the naval review which is to be held in connection with the visit of the Colonial Premiers on May 3rd. The whole of the Home Fleet will, however, be at Spithead on that day, and

full-power trials. Her speed touched 23 knots, which is a trifle above the estimated maximum speed for which she was designed. Cleaning operations are now being proceeded with, and at the end of May, she is to join the Fifth Cruiser Squadron of the Home Fleet at the Nore. The *Defence* will have been launched by the Countess of Cawdor by the time this appears in print, the ceremony having been arranged for April 27th. There will be no record breaking in the case of this ship. She is to be completed by December, 1908, and seeing that she was laid down in February, 1905, she will have been nearly four years in hand. The work of fixing the surface of the roller paths in the 7·5 inch barbettes is in hand. A machine specially designed for carrying out such work, which was hired from Messrs. Armstrong, Whitworth and Company, Newcastle-on-Tyne, for use on board the *Warrior*, is being used on board the *Defence* and £1 per day is paid for the use of it. The refurnacing of the boilers of the distilling and tank vessel *Aquarius* is being proceeded with. The old furnaces, which were formed of plain steel plates, have been removed, and others of corrugated plates are being substituted.



A MOTOR CRUISING YACHT FOR RUSSIA.

A VESSEL of a very interesting type has recently been ordered of Messrs. John I. Thornycroft and Co., Ltd., of Chiswick, a type, indeed, which should be of the greatest service for a river such as the Volga, for which this particular boat is destined.

The accommodation provided is essentially for a private party, and (as will be seen from the accompanying plan) this is ample in every respect.

The unique experience of the designers and builders is made evident in the convenient manner in which the various compartments are arranged, both fore and aft, leaving the maximum of floor space and headroom. This is in marked contrast to the cramped accommodation usually available in either steam or motor yachts of a similar size.

The dimensions of the boat are as follows:—

Length	70 ft.
Beam	13 ft.
Draught	2 ft.

The hull is of Siemens-Martin steel, galvanized, and the woodwork throughout is of teak.

Forward is a commodious saloon, with dining table, chairs, two sideboards and cushioned seats. Immediately aft of this are two single-berth cabins, each with folding lavatory, cushioned seat, etc. Following these on the starboard side is the toilet-room, with large bath, etc., and on the port side pantry with sink, dresser, ice chest and other fittings. The companion from these compartments leads to the upper deck.

Access is gained to the galley, which is between the owner's compartments and engine-room, by a separate hatchway from the deck. From this a serving

window communicates with the pantry. A cooking stove, ample for the requirements of 15 to 20 people, with coal bin, dresser and shelves, is provided in this apartment, the smoke and fumes from the stove being led away to the main funnel over the motor-room. The latter occupies a floor space only about 12 ft. by 8 ft., and contains two sets of motors driving twin screws. Fuel tanks of sufficient capacity for a run of about 12 hours at full speed are fitted on either side of the motor-room under the deck.

Aft of the motor-room is a second saloon, with settees at either side, writing cabinet, tables and chairs. This leads into a passage, on one side of which is a second lavatory, and on the other a store-room and cupboard. The crew space is situated right astern, and contains seats, lockers, etc.

The upper deck, with a canvas awning overhead, forms a very roomy promenade, and has sparred seats (with fresh-water tanks underneath each) on either side of the boat, forward.

The steering wheel and engine-room telegraph is also on this deck.

The motors are of the well-tried "Thornycroft" 6 in. by 8 in. four-cylinder type, using paraffin exclusively, and developing together about 100 B.H.P. on this fuel. They have magneto ignition. The controlling gear is very conveniently arranged, so that both engines may be easily controlled by one person. Their working parts are all of ample dimensions, durability thereby being ensured.

The design and construction of the motors generally have been carried out with a view to securing an efficient and reliable engine for ordinary commercial or private service, eliminating to the greatest extent risk of breakdown.

The reversing gear is of the new and improved "Thornycroft" C type, which possesses considerable advantages over anything hitherto produced for marine purposes.

The exhaust from the motor is led up to a silencer fitted at the base of the funnel, which carries off any fumes well above the awning. There is thus no likelihood of inconvenience from this source.

The speed guaranteed is twelve miles per hour. This will be comfortably attained by the motors at an economical rate of revolutions.

Generally speaking, the boat is a sound and handsome-looking vessel, and in view of the moderate initial cost, economy of working, and more particularly its suitability for passenger traffic on rivers or sheltered waters, it is likely to find favour in many parts of the world.

Holzapfel's Compositions Co., Limited, advise us that their compositions have been supplied during the year 1906 to more than 5,150 vessels, equal to upwards of 11,638,264 tons gross, and in addition thereto, large quantities of composition have been supplied to foreign governments, steamship companies and export merchants, from whom no returns of ships coated have been received.

NEW ZEALAND REPRESENTATIVES AT THE COLONIAL AND NAVIGATION CONFERENCES.

WE have pleasure in reproducing in our supplement a photograph of the reception dinner given by the retiring president of the Institute of Marine Engineers—Lord Pirrie—to the Premier of New Zealand and representatives of the Australasian Institute of Marine Engineers, and in connection with it the following notes on the guests will be of interest.

Sir Joseph Ward, the Premier of New Zealand, has been stated to be one of the most pleasant and sympathetic of men. His great capacity for work and powers of endurance are mingled with a kindliness that not only achieve great results, but along with these induce hearty co-operation on the part of those whose lot it is to work with him. Left fatherless at a tender age in the colony of Victoria, he was removed to New Zealand, where he, at the age of fourteen, entered the postal service, and three years later he left this for commercial work. His next move was to the railway service of the colony, where he acquired an insight into, and experience of, the management of railway traffic, which bore fruit in his subsequent most successful administration of the railways of New Zealand. At the age of twenty-one the future Premier commenced business as a merchant, and soon after he was elected a member of the local council of the town of Bluff, and attained to the dignity of mayor within the year of reaching his majority. The next step upward was his election to Parliament by a large majority of votes to represent the constituency of Awarus, situated in the southern part of New Zealand. The same zeal, energy and tact which commended him to his constituency as its representative, soon manifested to his colleagues in the Parliament of the colony that here was one whose characteristics called for a wider scope, and after six years of Parliamentary life he was elected as a Cabinet Minister, with the portfolio of Colonial Treasurer and Postmaster-General, the subsequent offices he held being those of Minister for Railways and Colonial Secretary. In 1900 a Government Tourist and Industries and Commerce Department was established by Sir Joseph, and has been acknowledged as most useful and progressive in advancing the interests of a colony which is eager to develop the resources of its land and its people. He next inaugurated the Public Health Department on lines of highest utility. The establishment of the Penny Postage within the confines of New Zealand in 1901 set an example soon followed by others, and now Sir Joseph seeks by his advocacy and by the argument of experience to induce the adoption of Universal Penny Post.

Mr. A. R. Hislop, secretary of the New Zealand branch of the Australasian Institute of Marine Engineers, is a native of Victoria, but at the age of ten removed to New Zealand with his parents, who settled at Dunedin, where he was educated. Removing to Wellington when twenty-one he devoted himself to matters of public utility and took a special interest in the Volunteers movement, an interest he has maintained for over thirty years, and holds the position of Lieut.-Commander in the New Zealand Naval Artillery, while for his long and efficient service as a commissioned officer he was awarded the Victorian Decoration by the late Queen Victoria. He took an active part in the last Maori rising, and equipped his company so smartly that it was the first to take the field when the necessity arose for action at Parihaka.

The business carried on by Mr. Hislop is that of agent for manufactures, chiefly in connection with engineering, in the town of Wellington, N.Z., where he is assisted by his son. He has held the post of secretary to the Australasian Institute of Marine Engineers for fifteen years with great acceptance to the members. His energy and push have been instrumental in advancing the claims and the interests of marine engineers in the colony, and now their position as important factors in both industrial and commercial enterprises is recognised and admitted. He is a Justice of Peace in the colony of New Zealand. The amendments made in the Shipping Acts of the colonies have been the subject of Mr. Hislop's active advocacy, and he attends the present conference on maritime matters as the chosen representative

Reception Dinner given by the retiring President of the Institute of Marine Engineers (Lord Pirrie) to the Premier of New Zealand and representatives of the Australasian Institute of Marine Engineers.

of the Australasian Marine Engineers. Mrs. Hislop accompanied her husband on this his first trip visit to the homeland, and their present arrangements are to return to New Zealand in the *Oroya*, sailing on June 14th.

He warmly supports a policy of reciprocal treaties of trade throughout the empire, so that the mother country and all her colonies shall work together in harmony for the greatest good to all as one.

Mr. Jas. Mills is chairman and managing director of the Union Steamship Company of New Zealand, he is at the same time an associate of the New Zealand branch of the Australasian Institute of Marine Engineers. From early youth he has been engaged in shipping industry, and in 1875 he established the line of steamers which has a world-wide reputation for enterprise, for the substantial comfort given to its travellers, and the good treatment of all connected with the company by its directors, an element tending to co-operation in bringing about a successful working for the best results. The Union Steamship Company has gradually grown with the growth of the colony, steamers have been built and improved upon year by year, and now there are some sixty steamers under the flag of the company, with a total of 130,000 tons. The steamers trade between New Zealand and Australia and the Islands of the Pacific, with branch lines to Calcutta and Vancouver. There are at present building in this country two or three new steamers for the company, and one of three superintendents now at home here, Mr. Paterson, was also present at the dinner, Messrs. Camphell and Wallace being unable to attend.

Mr. Mills was a member of the New Zealand Parliament for eight or nine years, when he represented Port Chalmers, but the increasing responsibilities in connection with business led to his retirement from Parliamentary life, to devote his time and attention more closely to business.

ELECTRICITY ON BOARD SHIP.

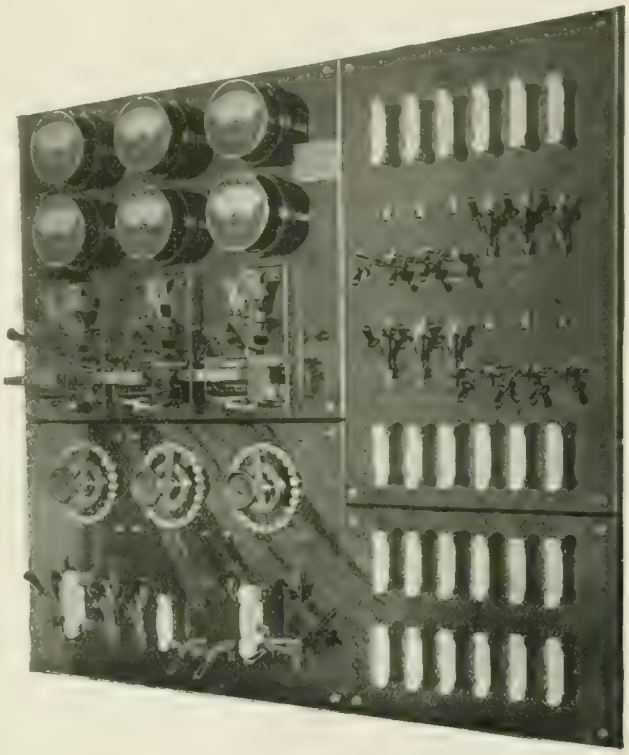
VIII.*

By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc. M.I.C.E., Etc.

The Main Switch Board in the Generating Station.

THE construction and arrangement of the main switch board in the generating station will depend necessarily upon the size and number of the generators to be dealt with, and the number of circuits to be provided for. The main switch board has been termed the clearing house for the electric current. It is to the main switch board that all the current from the generators is brought for distribution and for measurement, and it is from the main switch board that the current is taken to all parts of the ship. A properly equipped main switch board gives the engineer in charge of the generating station complete command of the whole apparatus. The main switch board for board ship use should consist of enamelled slate slabs, supported by iron framework, the different measuring instruments, switches, bus bars, etc., being mounted upon the slabs or panels, as they are called. On shore, marble has been largely employed, mainly because it requires less preparation and is a somewhat better insulator than enamelled slate, provided that there are no metallic veins in it. Slate itself is not a good insulator, but it has the important property of being almost incombustible, and it can be made a good insulator by giving it a good coat of well-baked enamel. The main switch board must carry the bus bars, where they are employed, these usually being fixed securely at the back of the board. It must also carry the switches that are to connect and disconnect the generators with the bus bars, and to connect and disconnect the distributing cables, or feeders, with the bus bars. It must also carry measuring instruments, enabling the engineer to see what current and what pressure each generator is furnishing, and what current each feeder is taking. In some cases on shore what are called pilot wires are employed, small wires fixed at different portions of the distribution system, and brought back to the main switch board, being connected there to a volt meter, and thus enabling the engineer to see at any moment what the pressure is at those points. The switch board also carries protective devices for the cables and the generators, in the form of fuses, to be described later on, which open the circuit of both generators or cables, should a dangerously heating current be passing in either of them. On shore the protective devices also include what are termed circuit breakers, apparatus which are more certain and quicker in their action than fuses, but which are liable, if a ship is knocking about much, to give out without the presence of the excessive current they are there to protect the cable or generator from. They are electro-magnetic devices in which the current, when above a certain strength, opens the circuit by a trip action.

For a single generator the main switch board is very simple. It will consist of one slab of enamelled slate, supported on an iron framework preferably. Occasionally switch boards are supported on wooden framework, but it is not wise. With changes of temperature wood is liable to change its form, and it is always wiser to keep inflammable material well away from the neighbourhood of the switchboard.



Main switch board made by Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.

On the single slab should be mounted one ampère meter, and one volt meter, one switch, which should be of the double pole type, as will be explained later, one pair of fuses for protecting the generator, and as many switches, also of the double pole type, and pairs of fuses, as there are pairs of distributing cables leading out from the switch board. With two generators there may be the same single panel, but with bus bars, or the equivalent arrangement on the independent system, with two double pole switches and two sets of fuses for the two generators, and as many double pole switches and pairs of fuses as there are distributing cables. There should be an ampère meter for each generator, and one volt meter to show the pressure at the bus bars, and a second volt meter for use when connecting a machine to the bus bars. Where the service is large, even where there are only two or three generators, that is to say, where there are a number of distributing cables, say for several portions of the ship, and for lighting and power, which should be supplied separately, it is better to have, if space will allow, separate panels for each generator, and separate panels for each pair of distributing cables. In this case the generator panels would

* For Articles I. to VII., see last seven issues.

each carry an ampère meter and volt meter, and a double pole switch and pair of fuses, each distributor panel carrying an ampère meter and double pole switches and fuses. The bus bars, where they are employed, or their equivalent with the independent system, would run along the whole length of the switchboard, being fixed at the back of all the panels. In some cases the bus bars are divided, the switchboard itself being divided into two or more portions, the two or more portions of the bus bars being connected together by special switches provided for the purpose. This arrangement enables one portion of the service to be disconnected from the other, for the purpose of testing. Where the pressure of the generators is regulated, as explained in a previous article, by varying the current passing through the field coils, by means of the adjustable resistance, the generator panels of the switchboard would carry the adjustable resistances mounted at the back, with the apparatus for adjusting it, usually a wheel moving a contact bar over a circle of contacts on the front. In some forms the wheel only appears on the front of the switchboard, the contact bar, contacts and resistance being all mounted on the back of the board, a finger on the front of the board showing the attendant where the contact bar is, and what resistance is in the circuit. Where any auxiliary apparatus is employed, such as where accumulators are charged from the generating station, and a booster is used to raise the pressure to the charging figure, the booster will usually have a panel to itself, or, if space will not allow of that, it may be accommodated upon one of the generator panels.

Where space will allow, it is convenient also to give the search lights, and even the cargo lights, separate panels. The whole of the arc lights, whether cargo lights or search lights, may be connected to switches and fuses fixed on one panel, or what would probably be a better arrangement, the search lights may be kept to their own panel, and the cargo lights to theirs. Where current is employed for power as well as for lights, it is wise to arrange the power circuits on their own panels, and the lighting circuits on theirs.

Distributing and Sub-Distributing Boards.

It may be as well, while dealing with switch boards, to describe the minor forms of switch board that are employed on the distribution system. One of the principal requirements in connection with any distribution system of electricity is the ability to control each separate circuit, whether it supplies lamps or motors, and to readily and quickly replace fuses, when they "blow," and to be able to trace cables in case of accident. For this purpose it is usual, on shore, and will be found of advantage on board ship, to divide up each main circuit into a number of branch circuits, and where the number of lights or motors are sufficient, to divide the branch circuits into sub-circuits. The arrangement, as will be explained more fully when dealing with cables, is, the main cables are brought to a convenient point, from which branches may be taken to different parts of the portion of the ship to be supplied, and each branch consisting of two cables is taken to another convenient point, from which wires to lamps or motors can be taken. The distribution boards consist of practically two bus bars, to which the main cables are connected, and to which the branch cables are also connected, each wire of each branch having its own fuse, bridged between it and the bus bar, and one wire of each branch, sometimes two, having also its own switch between it and the bus bar. The main cables also have their own double pole switch connecting them to the bus bars. The distribution boards are usually of enamelled slate, and all these are fixed in ornamental wood cases. On board ship they will be better enclosed in iron cases, somewhat similar to those used in marine work. It will be seen from the above that by this arrangement any particular district may be completely disconnected from the main distribution system, both at the main switch board in the engine-room and at the distribution board, while each branch can also be disconnected at the distribution board, and further, each branch of each cable is protected by its own fuses. Sub-distribution boards are similar to distribution boards, but smaller, and usually have only fuses between the bus bars and the terminals to which the terminals are connected.

The illustration shows another main switch board, made by Messrs. J. H. Holmes & Co., for a yacht built at Leith for America. There are two large dynamos and one small one, in the generating station, all running in parallel when required, the small dynamo taking the night load. The panel on the left is the generator panel. It will be noticed that it carries measuring instruments for each machine, also the rheostat for adjusting the strength of the current in the field magnet coils, also switches and fuses. The apparatus under the measuring instruments are the circuit breakers referred to above. The panels on the right contain the switches and fuses for the feeders, or distributing cables. The white objects are the fuses, having porcelain handles, so that they can be handled without inconvenience when replacing.

INSTITUTE OF MARINE ENGINEERS.

THE eighteenth annual general meeting of this Institute was held at the Hotel Cecil, Strand, London, W.C., on Friday, April 5th, when the president, the Right Hon. Lord Pirrie occupied the chair. The meeting was a memorable one in the history of the Institute, as immediately preceding the business, a most interesting ceremony was performed when the Right Hon. Sir Joseph G. Ward, Prime Minister of New Zealand, presented the gold emblem of New Zealand to the president of the Institute as a token of friendliness and esteem from the members of the Australasian Institute of Marine Engineers, and also presented a similar emblem for Mr. Archibald Denny, which was accepted on his behalf by Colonel John M. Denny (past president). There were also present representatives of the Australasian Institute of Marine Engineers, Mr. James Mills (managing director of the Union S.S. Co. of New Zealand), Mr. A. R. Hislop (secretary of the Australasian Inst. of Marine Engineers), now in this country as elected commissioners from New Zealand to the conference from which much improvement in the home country's relationship with the Colonies is hoped for, and Mr. R. Paterson (supt. engineer Union S.S. Co.). Prior to the meeting a dinner, of which we give a photograph in our supplement was held, on the invitation of Lord Pirrie, to the Right Hon. Sir Joseph Ward, Mr. James Mills, Mr. A. R. Hislop, Mr. R. Paterson, Sir Walter Peace, K.C.M.G., the past presidents of the Institute, of whom were present Mr. Asplan Beldam, Sir J. Fortescue Flannery, Bart., and Colonel John M. Denny, and the executive office-bearers and members of Council of the Institute, all of whom were present except Mr. W. C. Roberts, who was unfortunately detained by business at Hamburg.

The President, in opening the meeting, said: I must apologize for being late, but as this is the first occasion on which I have had the honour and privilege of meeting the Premier of New Zealand, Sir Joseph Ward, I know you will forgive us being a few minutes late over our dinner. I assure you that it is a great pleasure and gratification to me that I have been privileged to hold the position of president of the Institute of Marine Engineers on such an auspicious occasion as the visit of the Premier of New Zealand and also of the representatives of the Australasian Institute of Marine Engineers. We all know what a wonderful and vigorous country New Zealand is, and its development has been due, not only to its late Premier, Mr. Richard Seddon, whom we had the honour of meeting on the occasion of his visit to this country several years ago, but Sir Joseph Ward himself has done a great deal for the welfare of New Zealand, and since he has occupied the position of Premier has done a great deal in drawing it closer to the mother country, he makes every one feel as though they were part and parcel of ourselves. On the present occasion I do not intend to prolong my remarks, but I cannot help saying that on his visit to this country, representing New Zealand on this most important Conference of Colonial Premiers, the eyes of the old country, and I am quite sure of those he has left behind, will be watching his movements, and they will be listening to the words of wisdom which he may utter, not only in this Conference, but on occasions such as this. He will be watched by no one with greater pride and pleasure than by the members of the Institute of Marine Engineers, and I do not wish to do anything further at this moment than to welcome our friends; on your behalf and on my own I extend to our friends from New Zealand a most warm and hearty welcome.

Sir Joseph Ward: My Lord Pirrie and Gentlemen, I desire in the first place to thank Lord Pirrie for myself as well as for those who are associated with me for that cordial and hearty and warm welcome which he has been good enough to extend

to us, and I know our own people in New Zealand will appreciate the reference he has made to the old land and the younger Colonies, and his expression of the hope that the great Conference which the British Government has convened may be productive of good both for the older country and the newer parts of the Empire. New Zealand is proud of the position of being part of the British Empire, its people are "chips of the old block," and it is due to the pioneers of some seventy years ago, who went there through great difficulties, and under many disadvantages helped to found that young country, that it has built its foundations on a very solid basis. The men who went out so many years ago were representative of the British nation; they came from England, Ireland and Scotland, and their children are now carrying on the work of that young country of which the British world ought to be proud. I cannot, on such an occasion as this, attempt to anticipate what may be done at this Conference of Colonial Premiers, which is about to meet in London in the course of a week or two, but I am perfectly certain that these representative men from the distant parts of the Empire, free in the truest sense of the term, are proud to live under the British flag, are filled with a desire to assist in strengthening the Empire, to help to build it up under the flag of which we are so proud, and to try to impress upon those who may not realize in the truest sense how correct it is that true love follows the ship and the flag wherever the ship and the flag may go. I feel that in coming to London, to England, to the British Isles, that one is coming home. We always speak of the old land as "home"; our children, who have never seen it, always think of it and speak of it as "home." There has arisen in the Southern Seas a great country—and it ought not to be forgotten that it is as large as England, Scotland, Ireland and half of Wales—where a sturdy race of people are being reared, and in the future as you in this country grow in importance, so also will the great possession rise in importance. I take the opportunity of saying that I have a mandate from the people of New Zealand, having gone from end to end of it, to impress upon those at home what we believe to be best calculated to promote the interests both of our own countries, that we are anxious to do nothing inimical to the old land, but are desirous of welding still stronger that link of affection which New Zealand itself feels to the motherland. I wish to thank Lord Pirrie for his allusion to the late gentleman who filled the position of Premier of New Zealand and who on a former occasion represented our country in the old land with great ability. He applied all those natural talents with which he was endowed in the one direction, to improve the conditions of the people in his own land, and by doing so to still further add to the strength of the old world of which he was so proud. He is held in the most affectionate remembrance in New Zealand for the good work which he accomplished, he has left his impress upon the country and upon the people, and it was very gratifying to me to hear Lord Pirrie refer to him on this occasion. And now, Lord Pirrie and Gentlemen, I have a most pleasing and interesting duty to fulfil on behalf of the Engineers of New Zealand. Shortly before leaving the country they desired me to carry out a little duty which it affords me the greatest pleasure in giving effect to their wishes. Lord Pirrie has indicated that to-night he vacates the position of President of this Institute, and I do not think we could have a more fitting occasion than the present upon which to hand him on behalf of the Australasian Institute of Marine Engineers, the golden emblem of New Zealand as a memento of the respect and esteem which they have for one of whom we have heard in our country long before he held the high and honourable position which it is now his lot to fill, in connection with the great shipbuilding undertaking of which he is the head. He has been famous in the past as a captain of a great industry, and I feel perfectly persuaded that in the great sphere to which he has recently been appointed by His Majesty the King, he will add lustre to that noble institution. There are some 1,500 members of the Institute of Marine Engineers in Australia and New Zealand, and of that number over 400 belong to the city of Wellington, the capital city of New Zealand. They have done everything that an enterprising body of engineers can possibly give effect to for the improvement of the members of the Institute in that country and are carrying on an excellent work. The secretary of that portion of the Institute, Mr. A. R. Hislop, is here upon this occasion and will doubtless say a few words with greater effect than I can hope to in connection with this Institute in New Zealand. Upon a former occasion, the late Premier of New Zealand had the pleasure upon his arrival in London to present a similar emblem to Sir Fortescue Flannery, who was at that time president of the Institute of Marine Engineers, and it is very gratifying to see this link connected with the past which Sir Fortescue is now wearing, and I am sure it will be interesting to him to witness the presentation of a similar emblem on this occasion to Lord Pirrie. I do not think a more fitting occasion could have been made for the purpose of presenting this gold emblem with a suitable inscription upon it, which I have now the very greatest pleasure in asking Lord Pirrie to accept, and to say that I hope that, by-and-by, when he finds that there is time for breathing between the various vocations that he is called upon to fill, he will come out to New Zealand, if not on one of the White Star boats, on one of the other liners, and we will give him a "real good time of it" and send him back reinforced, reinvigorated with the ozone. I desire again to thank Lord Pirrie for the kindly, cordial and warm reception he has given us and to express the hope that he may long live to wear the emblem which I have just had the pleasure of presenting to him.

Lord Pirrie: Sir Joseph Ward and Gentlemen, I assure you I accept with the very greatest pleasure this emblem. It is one that I shall appreciate and it is one that I shall feel proud to wear, I hope, on many occasions. It is to me a very great pleasure to be the recipient of such a token of regard from New Zealand to the Institute of Marine Engineers. I do not take it as a personal compliment, but I do take it as a token of respect to the Institute in this country, and as a representative of that Institute it happens to be my good luck for the presentation to be made during my term of office. I should like to say a great deal more, but I know there is a lot to be done to-night. The Prime Minister, I understand, has also another gift to make and I will now call upon him to do so.

Sir Joseph Ward: My Lord Pirrie and Gentlemen, the members of the New Zealand branch of the Institute desired me to make a presentation to Mr. Archibald Denny, who has been elected a life associate of the New Zealand Branch of the Australasian Institute of Marine Engineers. I regret that owing to illness he is personally unable to be here, but his brother, Colonel Denny, who in the world with which we are so much concerned in New Zealand stands out very prominently, is here to receive it for him. We feel in New Zealand that we are a part and parcel of the Denny shipbuilding establishment, the fruit of which is to be seen on every coast throughout the country, and I am particularly pleased to see that the gentleman who is responsible for the building up of a fleet of steamers giving work to a very large number of engineers, Mr. James Mills, chairman of directors of the Union SS. Co. of New Zealand, is present upon this occasion. I can only now ask Colonel Denny to accept this gold badge from the New Zealand Engineers for his brother, Mr. Archibald Denny, to whom I hope good health will soon be restored and that he will live for many years to wear this token of our esteem.

Colonel Denny: My Lord Pirrie, Sir Joseph Ward and Gentlemen, I need hardly say that it is with great gratification that I find myself here to-night to accept on behalf of my brother this charming token sent him by the Engineers of New Zealand. I wish he had been here himself, however, for more reasons than one; first of all because, although I at one time belonged to an assembly which is supposed to engender the power of speech, he himself would be able to respond more eloquently and suitably. But Providence willed it otherwise; he has had to go away to another country on account of his state of health, and has not yet recovered. That he may be speedily restored is, I am sure, the heartfelt wish of every one present, and if anything will do him good it will be the fact that there are those who cherish remembrances of him and that away in the far Southern Seas which he once visited, and where this emblem was presented to him, he himself has not been forgotten, and the Premier of that country has not thought it beneath him to bring this token of esteem to present to him. Sir Joseph has alluded to the fact that certain works of ours are circulating in that corner of the Empire. I only hope that they may continue to circulate in ever-increasing numbers. We feel, of course, how much we are indebted to the gentleman who has already been alluded to, Mr. Mills; he has been a close friend of ours for many, many years and we have had many opportunities of recognising his talents which have placed him in the high

position he holds, namely, chairman and managing director in one of the most important companies in one of the most important Colonies in the British Empire.

Lord Pirrie: I now have pleasure in calling upon Mr. Hislop.

Mr. A. R. Hislop: My Lord and Gentlemen, I can scarcely express to you the pleasure it gives me to be present with Sir Joseph Ward and Mr. James Mills on this occasion to assist in conveying the greetings of the New Zealand Engineers to the Institute in London. As Sir Joseph has said, we look upon this as home, and this trip is to us a trip home. We have endeavoured in our little country to model our Institute on the lines of that in the old country, and although we have not the facilities and are not moving ahead as quickly as the Institute in London, we are doing very well. With the assistance of various friends we have been able to establish a very fine technical library, second to none in the North, as a technical library for engineers, and also a library containing light literature. We have two very comfortable rooms indeed, and just before I left, a scheme was being arranged for the purpose of acquiring our own property in Wellington. I have not had time to learn how the scheme is going on, but I hope to hear that it has been accomplished and we shall be able to offer those visiting us from this Institute a better welcome than we are able to do at the present time, that is, in the way of accommodation. The engineers in New Zealand stand in a very unique position. They have, thanks to Sir Joseph Ward, the late Mr. Seddon and other members of the Legislature, an Act on the Statute Books of the Colony which places them in the fore-front of engineers in the Empire. This Maritime Conference, I trust, will be the means of improving the status of those in the old country "who go down to the sea in ships," and I believe it will, for from what I can see there seems to be a desire on the part of shipowners of this country to raise the status all round of those engaged in marine work. The legislation that has been adopted in New Zealand, I am proud to say, meets with a great deal of approval around that part of the Empire, and I believe that it will also be an object lesson to our Australian brethren who are seeking to place on their Statute Books measures for the assistance and support of the sea-faring community. Sir Joseph Ward referred to the presentation to Mr. Archibald Denny. I should like to explain that while in New Zealand we made him a Life Honorary Member and presented him with a badge then, but unfortunately this was lost. This loss came to our knowledge, and as Sir Joseph was about to come to this country we thought it a fitting opportunity to replace the memento. I thank you very much, gentlemen, for the hearty reception you have given me. I can assure you that this visit to the old country is one of great pleasure to me and I have no doubt you will hear more of us in the future. We have been in correspondence with Mr. Adamson for many years and have also received copies of the transactions of this Institute. Our regret is that we have not a journal to send back in return, but never mind, Mr. Adamson, we may be able to send them soon, as when we get the new rooms papers will be read and discussed there, and I can assure the members of this Institute of a hearty welcome such as we have received here. Before sitting down there is one item I would like to mention, Lord Pirrie, which Sir Joseph omitted, the badge carries with it a wish that your Lordship will consent to become a Life Honorary Member of the Australasian Institute of Marine Engineers.

The honorary secretary was called upon to read his report in course of which he said: The session presided over by Lord Pirrie, which closed on January 31st, 1907, has proved a very pleasant and profitable one. The attendance at the various meetings has been fairly good on the whole, yet capable of improvement, and the attention of members is invited to the advantages afforded them of listening to the papers being read and of taking part in the discussions.

Suggestions from members with a view to adding to the value of the premises to visitors will be warmly welcomed, as the desire and wish of the office-bearers and council is to make the Institute membership a profitable investment to every one connected with it, by means of the technical papers and discussions, visits to works, social companionship, and other arrangements made and carried out for the general good.

We have lost by death during the year several members, who were well-known in the engineering world, and whose names are recorded in the report with regret and renewed expressions of sympathy with their relatives and friends.

We have to record the retirement and the resignations of several members, some of whom were more or less attached to the Bristol Channel Centre and who severed their connection after the rooms were closed at Cardiff.

The membership roll at the close of the financial year ending January 31st, 1907, stands at 974.

Sanitary Congress.—The Congress in connection with the Sanitary Institute is to be held in Dublin in July, 1907; and the Council have appointed Mr. James Girvin to represent the Institute of Marine Engineers at the Congress in compliance with the invitation received. The Congress during 1906 was held at Bristol and was reported upon by Mr. Williams, who represented the Institute of Marine Engineers on the occasion.

(To be Continued.)

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions of our correspondents.

Training of Officers and Men for the Mercantile Marine.

To the Editor of the MARINE ENGINEER AND NAVAL ARCHITECT.

Dear Sir,

In a letter addressed to me lately by a well-known shipowner, it was said that Underwriters should insist that captains of steamers should possess full or square rigged certificates, and not simply steam certificates only.

With this I heartily agree, and have been advocating it for many years in shipping circles, but, unfortunately, shipping men now have grown up amongst steam surroundings, and have their minds imbued with the idea that steam is so certain in its action, that while, of course, it would be better to have officers trained in sailing ships, still, as there are comparatively few sailing ships left to train them in, and also very few yards and sails to be dealt with in present-day steamers, the knowledge of how to deal with them is unnecessary, and apprentices can just as well be taken on board steamers to be trained thereon to manage steamers, as formerly they were trained in sailing vessels, to manage sailing ships. To my mind, no more dangerous idea was ever conceived than to suppose that steam-bred navigators will ever be equal to an emergency in a steamer's breakdown, and the emergency man is the margin of safety, with which every steamer, and especially mail boats and liners should be provided, and the only men capable of dealing with an emergency are those who have had to do with broken ropes and spars, jury rig, and occasionally sails blown to ribands, and who without the slightest fear have been used to holding on to top gallant masts, royal yards, and every possible exposed position under the most difficult and trying circumstances; these are the men to deal successfully with the broken-down steamer, and not the men who have simply been taught navigation, the rule of the road, etc., on a straight deck.

I fear very much for the safety of steamers when the sailing captains have died out. Where is the new race to come from, unless we devise some scheme of subsidising good sailing ships to take them for training, or the liner and mail boat owners combine together to institute seagoing training ships, such as was suggested by Mr. Brocklebank, Sir Alfred Jones and others lately, who spoke of arranging for ten 2,000 ton ships for the training of 1,000 apprentices for the mercantile marine. I also consider that both the *Worcester* and *Conway*, and, indeed, all training ships, should have their sea-going ships attached to them, where both officers and men should be taught all and every art of the sailor to perfection by thoroughly skilled navy seamen and masters, who have had the training of boys in the old navy sea-going sailing training ships.

One thing, I think, is certain that unless this matter is taken up very seriously and some of the old-fashioned attractions to entering upon a sea life are not re-introduced, that the dearth of officers and seamen for the mercantile marine will become so serious that foreigners will have to be engaged both as officers and men, and this would be simply apalling. Legislation in the way of shipping has generally been a far greater hindrance than a help to it, but I think the repeal of the compulsory apprenticeship system of about 1854 was one of the worst pieces of work that was ever done. We have the finest material in the world for the making of seamen, and our seamen of the past have very largely contributed to making Britain what it is, and yet the apathy with which most people treat this vitally serious subject is most extraordinary, and they appear to look with complacency on the 40,000 or so of foreigners already employed in manning our mercantile marine. What we should do in the case of war I cannot possibly foresee, and when we have such splendid material to work upon for the raising of British seamen and so many unemployed and youngsters growing up without being taught any form of handicraft, we are certainly not in this direction by any means doing our best in the interests of the country, and if Britain declines from her present maritime supremacy, it will be due to the apathy of the present generation.

When I was a boy and had to do with the owners of the North Sea Fishing Fleet, each smack and carrier (cutter) of 50 to 60 tons carried four men and four boys, and these boys were apprenticed from the workhouses, and splendid men they made; the eldest apprentices on board these vessels at eighteen and nineteen years of age were as strong and powerful as the men. These boys, when they were first fitted out with their serge suits on going to sea (for they were most liberally provided with a strong and useful outfit) looked as if they had all the material in their build and physique for the making of strong men. I daresay they were rope-ended at times, but they inevitably came home looking the picture of health and strength, and they could climb like monkeys. The collier sailing brigs also brought up a fine race of healthy, powerful and hardy seamen.

It appears to me that the only real sailors that we should have to fall back upon in an emergency, would be our sailing-yachtsmen; luckily a good many of them are kept going still.

A noble example was set in the rearing of British seamen when the *Port Jackson* took a hundred boys before the mast from the Marine Society's ship. I hope when this good ship arrives that Captain Ward will have such a good report to give, that other sets will be taken from other training ships, to continue the good work of maintaining the race of British officers and men. In my humble opinion the Admiralty are running the risk of both seamen and officers of the present day not being so well trained as daring seamen within four walls of colleges as in the old training ship schools on board ship.

I am, Dear Sir,
Yours faithfully,
THOS. F. AUKLAND.

ELECTRICAL NOTES.

(From our Own Correspondent.)

THE Committee of the House of Commons considering the question of the radio-telegraphic convention signed at Berlin last year, and the effect of the adhesion or otherwise by this country to its provisions, has had witnesses of various kinds giving evidence before it. Both the Admiralty and War Office are in favour. The Post Office predicts the use of the system eventually on every steamer, and is against giving a monopoly to any one company and is also in favour of the convention agreement by Great Britain.

Particulars have been published of the working of the Teltow Canal in Germany by electricity. This canal is in sections 21 m. by 2 to 2½ m. deep. The barges draw 1·8 m. of water and carry about 600 tons each. During certain portions of the route, motor tugs are employed, but generally the electromotives running on side walls are employed. The latter system is the more expensive of the two, though both systems take energy from overhead cables. The locomotives haul two 600 ton boats at a speed of 4 km. per hour and run on a metre gauge track, taking energy from a 500 volt. overhead wire by means of a bow collector through two 8 H.P. series wound direct current motors. The tow rope is a cable of 10 mm. wire and is attached to a drum operated through a friction coupling by a 3 H.P. motor, and so arranged that when the pull on the tow rope exceeds 1,200 kg., slipping will occur. This enables the locomotive to take up its load gradually, the drum slipping until the boat has attained a certain speed. At a speed of 4 km. per hour, the resistance is given as ·85 k.g. per ton and the energy consumption at 3·5 watt-hours per ton k.m. The efficiency of the locomotive has been found to be 65%. The tow boats are of various kinds, but an electrical one is of 3 motor driven propellers, the outer ones being of 20 and the centre 25 H.P. series wound. A battery of 220 cells with an output of 244 ampère hours on a 5 hour discharge supplies the current. These weigh 12 tons and are recharged through trolley arms. The consumption was 9 watt-hours per ton k.m. at a speed of 4 k.m. per hour, the system not giving more than 22% efficiency.

At the recent meeting of the Institution of Naval Architects, electrical control of gun gear did not altogether find the favour that was given to the hydraulic system, but on comparison of powers, the electrical method can hold its own, as the latter will permit of a starting overload not possible with hydraulic working. Thus it is shown that for the central hoist electrically a 15 H.P. motor is fitted which would require a 30 H.P. hydraulic press. Again in the rammer, H.P. of motor is 6, whereas the press is 12, while in the elevating gear, H.P. of motor is 10 and of the press 16. Taking economy as the standpoint, therefore, electricity is seen to be well to the front.

Referring to cranes for use in building or repairing vessels, a firm well known in this connection is that of Messrs. Applebys, Ltd., and a class of crane they make is that called their "tower" type, which stands on the top of a vertical erection from which it spans out and may be made to run on rails. One, particulars of which are before us, is capable of dealing with a working load of 60 tons and a maximum radius of 60 ft., adjustable down to 17 ft., the height from ground level and crane girder is 75 ft., and the lifting range, 85 ft., enabling a load to be picked up from 15 ft. below ground level. The construction comprises a roller path on the tower, the three motions of the crane being operated by separate motors, one for lifting and traversing and the other for sluing. The lifting and traversing motor is of 50 B.H.P., running at 500 revs. per min. and the sluing motor is 15 B.H.P. running at 450 revs. per min.

Planers in a machine shop must now be high speed, as this on the cutting stroke is aimed at, while the return stroke must also be completed in the shortest possible time. The machine the latest of this class is by Bateman's Machine Tool Co., of Leeds and was seen at the Machinery Exhibition in London last year, working on ordinary cast iron and taking a cut of ¾ in. deep with a horizontal feed of ⅛ in. The speed of the cutting stroke was 65 ft. per minute and on the return 220 ft. This speed is obtained by the use of a flywheel loose pulley with an overlapping belt and an automatic friction clutch between the flywheel and the fast pulley. The machine absorbs 7 H.P. on the cutting stroke and at reversal there is an increase to 25 H.P., which drops again to 12 H.P. at the end of the return stroke.

Motor driving of shop machines is a subject of the greatest significance and a paper recently read in Scotland shows this. Several conclusions are drawn by the author, among which is direct coupling as effecting a saving in current consumption. A flywheel is quite useless where a constant speed motor is directly coupled to a machine, and the reasons are given for applying a different class of motor and using the flywheel to obtain the advantages of the latter. He also goes into the question of reduction spur gear for the purpose of admitting of the use of normal speed motors. Gears of various kinds was a prominent feature of this paper, which was entitled, "The Mechanism of Power Transmission from Electric Motors," and was read before the Institute of Engineers and Shipbuilders recently, by Mr. W. L. Spencer, and which will be found to be of an interesting character throughout.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

GREAT activity in launching new vessels characterised a number of separate days in the industrial domain of Clydeside and other districts of Scotland since the writing of last month's notes. On Thursday, the 28th March, the day previous to Good Friday, Messrs. Napier & Miller, Old Kirkpatrick, sent off the steel screw steamer *Princess Dagmar*, a vessel of 236 ft. length, built for the Glasgow and Liverpool service of Messrs. M. Langlands & Sons. Messrs. Fleming & Ferguson, Paisley, launched the third of four 1400-ton hopper steamers which they are building for the Thames Conservancy Commissioners. Messrs. Mackie and Thomson, Govan, sent off a combined steam trawler and drifter of 125 ft. long for Dieppe owners, and intended for the fishing trade as it is prosecuted from French Channel ports. Two steam drifters were also launched from Fifeshire building yards intended for Moray Firth fishing port service. Messrs. A. & J. Inglis, Pointhouse, on the same date launched a vessel of a special character, *viz.*, a twin-screw train transfer steamer, named the *Lucia Carbo*, which they have built for the Entre Rios Railway Company. She is 293 ft. long, 58 ft. beam and 19 ft. deep to rail level—three lines of rails being provided in the width—and it is of interest to state that she was built close alongside the King's new yacht *Alexandra*, the launch of which has now been fixed for April 30th. Another busy day in the matter of launching was the 3rd. Messrs. D. & W. Henderson & Co., Partick, launched the steamer *Chikugo Maru* of 2530 tons for the Nippon Yusen Kaisha; Messrs. Archibald MacMillan & Sons, Dumbarton, the steamer *Glenmount* of 260 ft. length for service on the Canadian Lakes; the Grangemouth and Greenock Company, Grangemouth, the steamer *Aguilla* of 150 ft. length, for Chilian owners, and at Aberdeen two trawlers were launched for the Argentine. These vessels represent the third attempt that has been made to introduce trawling in the River Plate.

Perhaps the most important item of new work contracted for by a Clyde firm during April is the order which the Admiralty have placed with Messrs. John Brown & Company, Limited, Clydebank, for the machinery of the new cruiser *Boadicea*. This cruiser is the first ordered of the vessels authorized under this year's programme, and the hull will be constructed at Pembroke Dockyard, where Messrs. John Brown & Co. will fit the machinery on board. The *Boadicea* belongs to the *Scout* type, and may serve as a mother ship to destroyers or torpedo boats. For this reason she will have a speed of 25 knots, corresponding to the rate of the eight Scouts built two or three years ago. She is larger, having a length of 385 ft. and a beam of 41 ft., and at 13 ft. 6 ins. draught will displace 3300 tons. The machinery is to be of the Parsons' steam turbine type, and must be completed and the ship tried in sixteen months from now. The vessel is to be launched in October next, the trials are expected to be made in August of next year, and the vessel commissioned in the following October, so that from first to last only eighteen months are allowed for the whole work. The power is to be 18,000 horse-power to give the speed of 25 knots. There will be four shafts, each with a single propeller, and each shaft will have a go-ahead turbine. There will be separate small turbines for cruising at lower power, and the usual astern turbines. At full speed the main turbines will run at 500 revolutions per minute, taking steam at 170 lbs. pressure. The boilers, however, will work at 235 lbs. pressure, and they will be of the Yarrow small tube type, twelve in number, and will have over 40,00 square ft. of heating surface.

For the Glasgow-Montreal service of the Allan Line fleet a new steamer has just been ordered from Alexander Stephen and Son. Ltd,, Linthouse, who have at present on hand a similar ship for the same fleet for the Glasgow-St. Lawrence service, to be named the *Grampian*. The new vessel will be about 10,000 tons and will be fitted for a large number of passengers. A third steamer for the Allan Line is at present in course of construction in the yard of Barclay, Curle and Co., Limited, Whiteinch. The third vessel, to be named the *Corsican*, is slightly larger than the others, and is also intended for the Liverpool-St. Lawrence route. All the vessels will be propelled by reciprocating engines, and all three are being built to the highest class of the British Corporation Registry.

The Grangemouth and Greenock Dockyard Company have received an order from Canadian clients for a steamer intended for the lumber and general trade on the Canadian Lakes. The vessel, which is to be 240 ft. in length by 43 ft. beam by 22 ft., will be built in the company's Greenock yard, and is to be delivered in August. Another Canadian Lake steamer is at present on hand in this Greenock yard, and already several have been built and are in service on the lakes from the same stocks. In this connection it may here be noted that the Caledon Shipbuilding Company, of Dundee, who have also produced a number of steamers for the same service, have just received a further order for a Lake steamer, 250 ft. in length by 43 ft. beam by 20 ft. depth moulded, which is to be delivered in September.

The Grangemouth and Greenock Dockyard Company are reported to have booked an order to build the pontoon hull for a large floating crane which Messrs. Harland & Wolff, of Belfast, are reported to have commissioned a German firm to supply. The dimensions of the pontoon hull are to be 150 ft. by 85 ft. by 13 ft., and the electric crane which it is to carry is to be capable of lifting 150 tons to a height of 150 ft. The crane will be erected and supplied, it is believed, by the Benrather Company, of Benrath, Germany, who, it may be remembered, were responsible for the huge cantilever cranes of 170 tons capacity erected on the fitting-out quays at Beardmore's Works, Dalmuir, and at the works of Messrs. Vickers, Sons & Maxim, Barrow-in-Furness.

The Scott Shipbuilding and Engineering Company, Greenock, has been commissioned by the Clyde Shipping Company to build and engine a first-class passenger and cargo steamer to replace the *Portland*, which was sunk about six weeks ago near the Clock Lighthouse through collision with the *Welshman*. The new vessel is to be of good speed and will be delivered with despatch.

Apropos of the extending application of the internal combustion engine to ship propulsion, it is of interest to state that the vessel, 109 ft. 6 in. by 19 ft. by 6 ft. 6 ins., launched on the 11th April by the Ailsa Shipbuilding Co., Troon, for the West Highland fleet of David MacBrayne, Limited, and named the *Scout*, is being fitted with two oil engines driving twin propellers. Each engine will be of 130 I.H.P., of the four-cylinder "Quadruplex" type, made by the Griffin Engineering Co., Kingston Ironworks, Bath. The engines have cylinders 11 in. and 14 in. diameter, fitted with the company's patent hydro spray and non-firing automatic tube ignition. In addition the Lodge patent high tension electric ignition will be fitted as an auxiliary. The engines which are being built under Board of Trade survey (the vessel being intended for passenger service) are arranged to burn Scotch crude shale oil, generally known as "Lucigen" oil, having a density of ·975 to ·980, and flash point of 240 degrees Fah. This can be obtained at less than 2d. per gallon. It is of high calorific efficiency, if anything better than Russian refined petroleum costing 5½d. per gallon. The cost of working, therefore, is about one-third that of ordinary paraffin, the cost per B.H.P. per hour being less than one-fifth of a penny. With this oil a mean pressure of 95 lbs. per square inch is easily obtained, with a compression pressure of 75 lbs. The engines will run equally well on refined oil, crude Russian or Texas oil, tar oil, or Texas fuel or residual oil. The reversing will be effected by means of the Griffin Co.'s patent Invicta reversing clutch, the propellers being solid of progressive pitch. The Griffin Co. are also building for the Palmer Shipbuilding Co., of Jarrow, an engine of 100 h.p. in every respect similar to the above, which will work with the same fuel. This engine is intended for a large coasting barge of 450 tons, and is being built under Lloyd's survey. The Palmer Co. have also just been supplied by the same firm with a four-cylinder motor, which will also burn Scotch shale oil. This motor has cylinders 9 in. diameter by 9 in. stroke, and at 300 revolutions per minute, its maximum speed, will develop over 50 B.H.P. It is fitted in a small craft of the *Monitor* type of construction 57 ft. in length by 10 ft. beam, whose speed is to be about 10 knots.

THE TYNE.

(From our Own Correspondent.)

Shipbuilding.—The most important event in connection with Tyne shipbuilding this month has been the launch of the cruiser *Invincible* from the Elswick yard of Messrs. Armstrong, Whitworth & Co., at which establishment some other vessels of the highest class are still on the stocks. A rumour has gained currency in commercial circles that the Spanish Government contemplate making additions to their fleet, and that the Elswick yard will probably be the first British shipbuilding establishment to be entrusted with an order from this source. It is also stated that the company have received an order for a large oil carrying steamer, and at the Low Walker yard, as well as at the Elswick establishment, the prospect for the near future is good.

The Palmers Company launched on the 15th inst. a very fine cargo steamer for French owners, and are now fitting the engines, boilers and other accessories on board. The announcement has been made that this company have received an order from the Tyne and Tees Steam Shipping Company for a steamer of moderate capacity. Messrs. Swan, Hunter & Wigham Richardson have this month launched another fine steamer for New Zealand and it is understood that the company have secured some further work from foreign and Colonial sources. The work of fitting out the *Mauretania* is being pushed forward with all possible despatch, and it is expected that the vessel will be ready for her trials in August.

At the annual meeting of Messrs. Robt. Stephenson & Co., held at the end of March, the chairman made the satisfactory announcement that notwithstanding the large output of the previous year, there are still seven steamers in hand and on order, and he gave expression to the belief that in the coming twelve months, the large graving dock will have even more business than it has hitherto had, which is saying a good deal. The past year's work has resulted in a profit of over £52,000, this being an increase as compared with the net earnings of the previous year of £16,000. In the marine boiler shop, work is fairly plentiful, and it is expected that the new foundry will soon be actively employed. The shipbuilding department of the Smiths' Dock Company is very busy, and the output for the first three months of the year is, we believe, in excess of the output of the corresponding period in any former year. The company's graving docks and pontoons are all occupied with vessels under repair, and this does not comprise the whole of the work in hand, there being a number of vessels receiving attention at mooring places in the river.

Engineering.—It would seem that the operative engineers are, after all, disposed to persist in their demand for an advance of wages, as meetings have been held at different centres in support of the movement. In all probability, a ballot will be taken on the question of demanding or refraining from demanding an advance, and this ballot will doubtless result in a vote in the affirmative sense being given. A stoppage of overtime is also talked of; but we very much doubt the willingness of the employers to acquiesce in this arrangement. It is well known that there is an over-abundance of tonnage at the present time, and that orders can only be obtained by the very keenest cutting of prices. An advance of wages, which would necessarily involve a corresponding advance of prices, would most assuredly put a further check upon the placing of orders, and if there is a lack of orders, there must certainly follow, a lack of work. It is only in a time of urgent demand—demand that must be met—that wages can be advanced with safety, and all business men are well aware, if the working men are not, that no such demand exists at present. It is to be hoped the men will be wise in time; for if they enter upon a struggle with the employer about this matter, they most certainly invite disaster. In the larger marine works there is still a fair show of activity; for work that has been undertaken must be got out; but it is easy to see that a slack time is impending, as the designers and pattern makers have little to do. In the smaller works, a fair state of business is maintained, the establishments at Walker Gate, that are engaged chiefly in the manufacture of steamship accessories, being still pretty well off for orders. Electrical engineering works are still kept going briskly, and it is not anticipated that any slackness will be experienced in these establishments for several months to come. Steel works at Newburn, Consett and Jarrow, are extremely busy, there being a strong demand for this material in constructional work ashore, not to speak of shipbuilders' and engineers' requirements in the carrying on of their respective lines of work. The demand for angle and bar iron is also well maintained, and the output at some of the works is larger than has been noticeable for some time past. Many of the iron foundries are showing signs of incipient slackness, but brass foundries and copper works are still doing well. The competition of Germany in forgings is keener than ever, with the result that the decadence in the local forging industry, is daily becoming more widely manifest.

THE WEAR.

(From our Own Correspondent.)

Shipbuilding.—Messrs. S. P. Austin & Son have launched their third steamer for the year, and if this rate of output is maintained during the remaining months, the result at the close is bound to be eminently satisfactory. Since the adoption of the "Joggle" plating system at this yard some two or three years ago, the output of tonnage has shown a marked increase, although the increase may perhaps to some extent be attributable to other causes. The firm are now laying down an extensive gas plant for which additional space has been provided, and it is understood that they contemplate other improvements, among which may be mentioned the adoption of the pneumatic principle in riveting and caulking.

Messrs. J. L. Thompson & Sons have launched four vessels this year and another will soon be ready. At this establishment no berth remains long without an occupant, the custom being to put down the keel for a successor the moment a berth becomes vacant. We note that Mr. James Marr, managing director, has been appointed a Justice of the Peace for the County of Durham. The yards at Deptford, Pallion, and Southwick are, with one or two exceptions, showing a fair amount of work on the stocks. Ship repair work on the Wear is at present rather scarce, but an improvement is hoped for.

Engineering.—At one marine engine works on the Wear, which for years past has shown uninterrupted briskness, the night shift has been discontinued, and a large proportion of the employés have in consequence been discharged or suspended. This may be taken as a sign of the times, for the firm in question is one of the highest repute, and would not be short of orders if orders were easily obtainable. It is not very encouraging to those who are clamouring for an advance of wages, and the mere recital of the circumstance ought to convince even the most obstinate that the time is inopportune for seeking any augmentation of the wages rates. Messrs. Lindsay, Carverhill & Co., engineers and ship repairers, are erecting a new building in extension of their works, and are ordering new machinery for the equipment of the additional premises. The sections of a mammoth oil engine have been delivered at Messrs. Craven & Speeding's rope works, Fulwell Road, and when connected, will constitute the largest oil motor in the district. The engine is, we understand to supersede three or four smaller engines that have hitherto been driven by gas or steam. The bed-plate is said to weigh about 15 tons and the approximate weight of the whole is understood to be over 100 tons.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

THE Manchester Ship Canal Co. was incorporated in August, 1885. Its present loan capital is now £9,500,000, and its share capital £9,000,000. Upon the latter nothing has been paid in dividends since the payment of the interest out of capital during the construction of the undertaking. Thus 50 per cent. of the capital has, for over twenty years, proved unremunerative.

Messrs. Lamport & Holt have recently added a steamer named *Voltaire* to their Anglo-American fleet. She is fitted with telescopic topmasts, so as to be able to navigate the Ship Canal with ease. Her full length is 501½ ft., breadth 58 ft., and depth to main deck 29 ft. The registered tonnage is over 8000, and she will carry 11,000 tons deadweight. A good deal of attention has been paid to the cattle accommodation. The vessel is supplied with all modern appliances.

Oil fuel for use on board steamers is spreading to the detriment of the coal trade. Recent experiments with oil for torpedo craft seem to foreshadow a further important extension in its use. Speed and fuel consumption results indicate a remarkable improvement compared with reciprocating engines and coal-fired boilers.

Early in the month the steamer *Woodcock*, one of the Burns' line, arrived at the Manchester Docks, having on board Lord Inverclyde and other directors of the line, who were engaged in making a round of visits to various seaports. On the vessel were also Rear-Admiral Arbuthnot, Rear-Admiral Farquhar, Captain Inglefield, R.N., secretary to Lloyds, and Captains Acton Blake and Clark, Brethren of Trinity House, Mr. Austin Taylor, M.P., and Mr. A. Bonar Law, M.P. The party having visited the various docks and warehouses, dined with the chairman and several of the directors of the Ship Canal Co. The company re-embarked the next day for Ardrossan.

The bill which is to be promoted by the Ship Canal Co. relating to the coal under the Bridgewater Canal will not in any way impair the security of the Corporation loan. On the contrary. its aim is to prevent possible damage to such security, and will place the company in a much safer position than at present, besides allowing the coal to be worked, which will bring a large traffic to the Bridgewater Canal.

It is estimated that the Manchester city rate for the year will be reduced by 2d. on the Ship Canal account, making it about 1¾d. in the pound, and it is hinted that next year no rate will be necessary. The improving income from traffic is, of course, the cause of this lightening of the ratepayers' burden. In 1902 the Ship Canal rate was more than 1s. in the pound. Since then it has gone down to 9¾d., 5¾d., 4½d. and 3¾d. The rates went down in proportion as the profits from traffic went up, as it was foretold they would. Progress in this direction has been about as quick as could be expected, and Manchester has excellent reasons for congratulating herself on the fact that at the time the crisis in the Canal's affairs were reached the Corporation slipped into the breach and filled the gap with the necessary millions. Everybody admits how largely the city and district has benefited by the Canal.

The arrivals of cotton up to date at the Manchester Docks exceed all previous records. The total of American and Egyptian bales approaches 600,000.

The results of the timber trade at the Manchester Docks during the first quarter of the present year has been marked by fairly large imports, rather smaller deliveries, and the increase of stocks as compared with the first quarter of 1906. Imports:—Saw pitchpine, 587,000 cubic feet; pitchpine planks, 30,000 cubic feet; birch, logs 6000; birch planks, 19,000; spruce deals (standards), 4350; pine deals, 219; Baltic deals, 1080; and Baltic flooring, 2260. The only increases in consumption are in birch logs and planks, pine deals, Galatz whitewood and American oak.

The quarter's trade returns show the enormous increase of nearly £17,000,000 in the value of our imports as compared with the corresponding period of 1906, and an increase of nearly £10,700,000 in the value of our exports.

During the month considerable quantities of grain have arrived at Manchester Docks from San Francisco, one vessel alone, the *Theodora de Larrinago*, bringing 42,857 bushels. Cargoes of wheat have also arrived from the Baltic.

The British Westinghouse Co. at Trafford Park are engaged in the manufacture of some of the largest turbine units ever installed. Each has a maximum output of 11,000 h.p., while the floor space taken up is less than 43 feet. They combine the principles of action and reaction. By admitting steam through a stop valve and a steam strainer to a regulating valve which admits the steam into a nozzle chamber fixed to the inside of the turbine casing, the steam falls in pressure to about 60 lbs. per square inch absolute, and builds up such velocity as to be economically taken care of in two rows of impulse buckets. This treatment of steam enables a high degree of superheat to be employed, which is converted into work without causing distortion to the rest of the turbine where Parsons' blades are employed. Specimens of this manufacture can be seen in the power stations of the London underground railways.

The engineering and textile manufacturers in the Manchester district are enjoying a lengthened period of good trade. At the American Car and Foundry Co., Trafford Park, which borders the Canal, an order was received a fortnight ago for 2000 waggons.

The coal trade in the Manchester district continues brisk in all qualities of steam and engine fuel at the increased prices fixed some time ago. House coal is in less request. The increase of 5 per cent. in miners' wages comes into force on the first making-up day this month. A good deal of coal is being exported. Furnace coke finds a ready market. Current prices at the pits are as follows:—Best house coal, 14s. 6d. to 15s. 6d; secondary, 13s. 6d. to 14s. 6d.; common, 10s. 6d. to 12s. 6d.; burgy, 8s. 10d. to 9s. 6d.; best slack, 8s. to 9s.; medium, 7s. to 8s.; low qualities, 6s. 6d. to 6s. 9d.; coal for shipping, 12s. to 13s. f.o.b. at Garston; furnace coke from 17s. to 24s. per ton. Dearer gas coal and cannel will mean an increasd expenditure on the part of the Manchester Corporation of several thousands of pounds.

The Manchester iron market is steady. Prices of the raw and manufactured iron have varied very little during the month. Textile machinists are everywhere very busy, but there is a little slackness in engineering generally. Electric machinists are fairly well off for orders. The motor and cycle trades are brisk. Average quotations on the iron quarter of the Royal Exchange are as follows:—Scotch metal: Eglinton, 70s.; Dalmellington, 69s. 6d.; Glengarnock, 72s.; Gartsherrie, 73s. per ton delivered at the Manchester Docks; 2s. 3d. less if landed at Fleetwood or Heysham, and 1s. per ton less if shipped to Preston. G.M.B. Middlesbro' iron, 64s. 3d.; Derbyshire, 62s.; Staffordshire, 62s.; Lincolnshire, No. 3, 62s. 6d.; do. foundry, 61s.; do. forge, 59s. per ton delivered Manchester. Hematites (West Coast), 74s. 6d.; do. (East Coast), 77s.; billets, £6 10s.; scrap iron from 55s. to 60s. per ton. Copper and tin have fluctuated considerably during the month, but seamless copper and brass tubes and braized copper tubes have been maintained at the following rates:—Seamless copper, 14¼d.; braized do., 14d., and seamless brass tubes 11½d. per lb. Manufactured iron: Bars, £7 15s.; steel: rounds and squares, £8; flats, £7 10s.; angles, £7 2s. 6d.; tees, £7 10s.; joists, £7 5s.; channels, £7 15s.; iron hoops, £8 7s. 6d.; steel boiler plates, £8 12s. 6d.; do. ship plates, £8.

THAMES.

(From our Own Correspondent.)

THE view that it was going to be plain sailing for the Dock Co.'s bill through Parliament is apparently dispelled. This measure, it will be remembered, proposed that goods and materials imported by the Thames should be liable to port dues, and als othat a toll should be levied on barges entering the docks. These new charges, which varied from 9d. to 5s. per ton, were to be paid by the importer, while at the same time the tonnage rates on shipping were to be substantially reduced. The revenue arising under the bill was to be divided between the three dock companies and the Thames Conservancy. The London waterside manufacturers and the merchants and shippers are against these proposals, and argue that by means of a private bill introduced by one of the conflicting interests the whole of the trade of the port is to be regulated, and that this is obviously unfair to other parties concerned.

Matters are not rosy as far as shipbuilding goes on the river at present. Men-of-war have been a feature at the Blackwall yard, but as vessels have become larger and the Admiralty contract last year was of this type, there is no dock on the Thames, the report of the shipbuilding company says, where such a vessel can be completed, owing to the width of beam of such a vessel. With the approaching departure of the two torpedo boat builders from the river the significance of our remarks is clear.

The Thames is to have its dearly-bought steamer service in operation again this summer. The Highways Committee of the new Council has gone closely into the matter, and finds that it has three courses open to it, (1) to do nothing more to the boats, (2) to keep the boats in first-class repair and ready for sale, and (3) to run them on a 4½ months' summer service. The tale is a doleful one whichever way it is looked at, a sum of £42,000 odd being paid by general account to meet the charges on the steamboats for last summer's working.

The Orient Steam Navigation Company show a credit balance of £17,950 and pay a dividend of 5 per cent. on their deferred shares. Mr. J. G. S. Anderson, the head of this firm, has recently died. This gentleman was a strong advocate of the water-tight bulkhead, and it was largely through his influence the principle was adopted. Other matters relating to ships he was also very strenuous upon. He had been a member of Lloyd's Committee, a president of the Chamber of Shipping and chairman of the General Shipowners' Society.

The General Steam Navigation Co. has held its meeting, there being an increase to report of £35,000 gross. There has been a loss of one of the company's vessels during the year and which they are replacing. In the report opportunity is taken to emphasize the necessity of a new port authority for the control of the Thames, and the company is evidently against any taxation on goods.

The matter of the large discharge of men from Woolwich Arsenal, to which we have previously referred, has culminated in a march by the men to the Houses of Parliament. That there are now so comparatively few men employed at Woolwich is a serious matter for the town, but more serious for the general labour market, which has to absorb the discharged men, and if the engineering trades are not in exceptionally flourishing condition it becomes, of course, a matter of some difficulty, but the trades union should be able to adjust these differences, if working on a sound basis, it would be thought.

Captain John Graham, R.N., has been appointed inspector of the water guard of the Port of London with residence at Gravesend. The appointment is said to be worth £650 per annum.

With some éclat the new premises of the London School of Nautical Cooking was opened at the Sailors' Home, Well Street, by the Marquis of Graham, the new Merchant Shipping Act making it imperative that a vessel of 1000 tons and upwards has to carry a trained and certificated cook. The new premises in Well Street will provide accommodation for 24 pupils at a time.

From recent experiences at Dover Harbour the Admiralty have altered several of the moorings laid down there. The question of rearranging the entrances to the port so as to avoid the dangerous currents has been under consideration, and it is believed the proposals will obviate the difficulties that have arisen. The Harbour Board is desirous of increasing the poll tax on passengers from 1s. 6d. to 2s. 6d. to raise £1,000,000 for reclamation purposes on either side of the Admiralty Pier, which will be widened to 300 ft. and a first-class station erected thereon. The only opposition came from the Belgian Government with respect to their Ostend steamers and the inability of the line to pay any increase.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow.—The shipbuilding trade of this district has considerably improved during the past month, because Vickers, Sons & Maxim have adopted a new policy, that of securing more commercial orders. For some time past they have confined themselves largely to warship construction, for which purpose they have specially equipped their works, but it is not always possible to secure orders for warship tonnage, and in order to keep their yard employed, and with the view of keeping their workmen together, they find it is better to dovetail in some mercantile orders until such times as they can command more important contracts. This firm is in the position to clear off orders for mercantile tonnage very quickly, as they have every facility for rapid and economic production, and when Admiralty work comes their way, either for the home or foreign Governments, they can forthwith take it in hand, because they have any number of vacant berths available.

During the month they have secured another order from the London and North-Western Railway Company to build a fast passenger steamer for their Holyhead and Dublin service. This vessel will be about 300 feet long, and will be propelled by twin screws at a speed of 23 knots per hour. A short time ago they booked an order from the same owners for two cargo boats for the same service, and the work of building these vessels has already commenced. They have also in hand a powerful tug boat for the Furness Railway Company, and also a large barge for the same owners. They are also building a service steamer for the Indian Government. The reported order for a Mexican transport vessel has not yet been secured, but the firm have now on hand quite a number of small orders which are engaging their attention, and they are in treaty for more work which it is hoped will be realized at an early date.

In large work they have on hand the Brazilian battleship of 19,000 tons displacement. This vessel will carry the same number of 12 in. guns as the British *Dreadnought, viz.*, ten, but they are so disposed that all of them can be fired on either broadside, while in the case of the *Dreadnought* only eight can be fired from either broadside. This will give the Brazilian warship a very great advantage over her British competitor. It is proposed to place the turrets with their pairs of guns at different levels. Thus behind the pair of guns in the forecastle there will be a pair of 12-inch guns at a higher level on the centre line. This plan has been adopted in the United States Navy with very great success. The secondary armament will include a large number of 4 inch or 4·7 inch guns. The vessel will have a beam of about 84 feet, and as she has to have a speed of 20 knots it will readily be understood she will require an immense engine power. It is not known whether she will have reciprocating engines or will be driven by steam turbines, but in all probabilty the latter will be adopted, as the success of the *Dreadnought's* turbines has been established. The keel of this monster warship has already been laid, and the work of her construction will proceed as rapidly as possible. It is expected the vessel will be completed in about two years.

It is interesting to note that a Commission from the Mikado's Government has been despatched to this country with Prince Fushima at its head with a view of placing an order in this country for a 21,000 ton *Dreadnought*, and it is understood that the order will be placed either with Vickers, Sons & Maxim or with Armstrong, Whitworth & Company, on the Tyne, the builders of the most recent additions to the Mikado's fleet. At Barrow there is only one large vessel on the stocks, whereas at Armstrong's there are three *Dreadnoughts* in course of construction. It is, therefore, thought probable that the order will come to Barrow, and particularly so as the *Mikasa*, Admiral Togo's flagship during the late war, gave such great satisfaction, and the more recently built warship the *Katori*, delivered since peace was proclaimed, has also given the greatest confidence to her owners, not only by the effectiveness of her guns, but by the speed attained on her trials and in her voyage out to the Far East. At any rate Prince Fushima and suite have fixed Whit-Monday for their visit to Barrow, where they will be received by the directors of Vickers, Sons & Maxim, and will be shown over the great yard at Barrow with its many thoroughly up-to-date facilities for the turning out of the most modern warships. Barrow is now fortunately in a position to build warships of any size, as a new fitting-up wharf, with a new electric crane to lift 150 tons, has been provided in the Buccleuch Dock, and the work of widening the passage way into this dock from 80 to 100 feet wide is proceeding, and will be ready for use in October in the current year.

The Vickers firm are also tendering amongst other vessels for the new 23-knot turbine passenger steamer required by the Isle of Man Steam Navigation Company. The enquiry for new commercial tonnage has not lately been large, but there are prospects of considerable business in great warships, as it is known that Brazil has more orders to give out, while the Argentina Republics and the Chilian Republic are in the market for new warships. Brazil has set the

fashion in South America, and the other Powers recognise they must also be on the *qui vive*. Indeed, Peru, for which Republic Barrow has just built two admirable cruisers, is said to be on the point of adding to her Navy, as the prospect of the opening of the Panama Canal in the near future has demonstrated the necessity of being prepared to protect her territory, not only against South American Powers, but against other Powers who will be on the *qui vive* to the immense and valuable resources of Peru.

The *Dreadnought* age has opened up a very promising vista, for makers of guns and heavy ordnance particularly. Orders are already well held, and the probability is that a still greater demand will be experienced for heavy ordnance in the near future, as the new *Dreadnoughts*, with their heavy guns, have almost made guns of less calibre non-effectives in the case of war. The gun-mounting department at the Barrow works of Messrs. Vickers are very busy, and are likely to remain so for some time to come.

Marine engineers are also very busy, and have now a considerable number of orders on hand.

West Cumberland.—A very steady trade is being done at the shipbuilding yards in West Cumberland. Both at Workington and at Maryport the yards have as much work in hand as they can do, and although the vessels built are of small tonnage there are plenty of them, and more orders likely to follow those now engaging attention.

Shipbuilding Material.—The demand for shipbuilding material at the moment is quiet, but there are prospects of greater activity in the early future. Ship plates are at £7 10s. per ton net cash, and boiler plates are at £8 10s.

Hematites.—The demand for hematite iron has improved, and makers are well supplied with orders. Mixed Bessemer Nos. are at 78s. per ton net f.o.b., and warrants are at 74s. 6d. net cash. Stocks have been substantially reduced.

Shipping.—The exports of iron and steel have increased very largely this year. They have now reached a total of 290,799 tons, an increase of 45,085 tons on the corresponding period of last year.

BELFAST.

(From our Own Correspondent.)

AT the fitting-out wharves on the Lagan there are new vessels with an aggregate of close on 90,000 tons. Repair work is somewhat slack, but with the existing want of graving-dock accommodation there can be no great activity in this branch of the trade. The harbour authorities have intimated that they expect to have the Alexandra Dock at the disposal of the shipbuilders by August, but a glance at the present state of affairs is sufficient to show that the contractors have an almost impossible task before them to complete the repairs by that time. The cutting off of the damaged portion—briefly described in a previous issue—has been successfully accomplished, and the dock pumped out, and the actual repairing is now in progress. The entire outer end of the dock, sides and floor, have practically to be rebuilt, and the work will be carried out in such a manner as to preclude all danger of a recurrence of the subsidence which caused the enormous damage.

On the 28th March the steel screw steamer *Prahsu* was launched from Messrs. Harland & Wolff's yard. This vessel is the last of a quartette ordered from the Queen's Island by Messrs. Elder, Dempster & Co. She is 370 feet long, by 49 feet beam, and about 4000 tons gross. In addition to the *Prahsu* Messrs. Harland & Wolff have at present at the fitting-out wharves her sister ship the *Bulani*, the Royal Mail Steam Packet Co.'s *Avon*, the Hamburg-American liners *President Lincoln* and *President Grant* and the big White Star liner *Adriatic*. The last-named is receiving her finishing touches, and will be ready for sea by the time these notes are in print. Her departure will be followed early in May by that of the *President Lincoln*. This steamer and her sister ship, the *President Grant*, are the two steamers which were launched rameless some two or three years since. After being laid up for a considerable period their completion was started upon with the object of running them under the Leyland line flag as the *Servian* and *Scotian*. Later on they were bought by the Hamburg-American Company, and renamed by them *Berlin* and *Chicago*, this firm subsequently again changing their names to *President Lincoln* and *President Grant*. Few vessels have undergone such a course of shuffling in nomenclature between the time of their launch and completion for sea. To replace these vessels Messrs. Leyland have recently placed an order for two steamers of about 6000 tons gross with the Queen's Island firm.

Messrs. Workman, Clark & Co. will launch at the end of April the Brazilian-Lloyd liner *Pará*. The *Ceará*, the first of the batch of steamers for which this company placed the order with Messrs. Workman, Clark & Co., is at present fitting out, and will be ready for her trial trip in the course of a week or two. On the 27th of March the new steamer *Chyebassa*, built by them for the British India Steam Navigation Company, had a trial run in the Lough, afterwards proceeding to the Clyde for speed trials over the Skelmorlie mile. These tests were entirely satisfactory to all concerned. The *Chyebassa* is 445 feet long, with a gross tonnage of 6200 tons. The propelling machinery consists of a set of triple expansion engines supplied with steam by four boilers working under Howden's forced draught system. Politics do not come within the region of The Marine Engineer, but it would not be fitting to pass from the mention of this firm without reference to Mr. George S. Clark's election to Parliament. Mr. Clark contested North Belfast seat—rendered vacant by the lamented death of Sir Daniel Dixon—in the interests of Unionism, his opponent being Mr. William Waker, a labour candidate, who has failed in his third attempt to capture the division. The popular shipbuilder won with an overwhelming majority. He is an able speaker and should be a valuable acquisition to the Unionist benches.

Messrs. MacColl & Co. have received an order for twin-screw engines of about 1000 I.H.P. for a steamer to be built by the Ailsa Shipbuilding Co. for Vancouver.

Mr. Robert Thompson, J.P., has been selected to succeed the late Sir Daniel Dixon as chairman of the Belfast Harbour Commissioners. Mr. Thompson, who has been a member of the board for the past fourteen years, has always taken a keen interest in the affairs of the port. A man of sterling character and very considerable business capabilities, the further advancement of the interests of the port is assured under his guiding hand.

JUNIOR ENGINEERS.

VIII.*

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

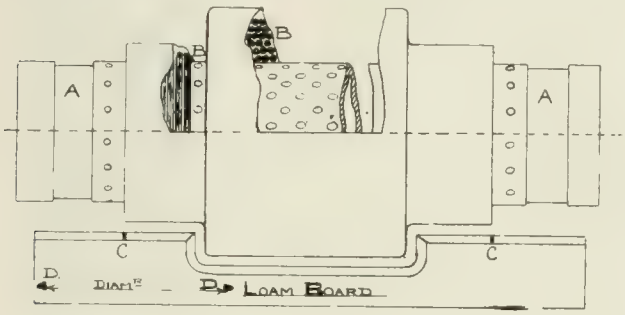
Moulding *(continued)*.

THE cylindrical beam core is turned up an a hollow cast-iron bar, 3 or 4 inches less in diameter than the required core, having its walls pierced with a number of holes to permit of the escape of the generated gases; journals, A, are turned on the ends of this bar upon which it rests in V bearings. The bar is rotated, either by means of a handle or belt and pulley attachment; hay or straw ropes, B, are wound on and then loam plastered over this to make up to the required diameter, the excess being strickled off with the loam board. The board is set out from the axis of the bar the required distance to give the correct diameter of core as obtained from the board at D, by means of notches or a strip of wood sprigged to the board, the overall length of the core being fixed by notches at C.

For the larger cores of this type the bar is replaced by a brickwork setting, a spindle is erected on the floor to which the loam board is attached, and round which it is rotated

* For Articles I. to VII., see last seven issues.

in sweeping up the diameter and form of the core; the brickwork, built round this spindle, is plastered over with a coat of loam for the thickness of an inch, this is dried and then another coating of finer loam is put on to make up to the finished diameter, also an inch thick, the unnecessary material being removed by the loam board; this core is then dried and blackwashed and either lifted bodily into place or the mould built up around it, a cast-iron plate being used as a support. In forming the core for a turbine cylinder, a wooden sole-plate is made, upon which semi-circular end-pieces are erected corresponding in diameter to the cylinder at either end, the centres being raised sufficiently above the sole-plate to provide for the print and machining allowances; the sweep board is provided with arms which extend down to the centres of these end-pieces, where they rest upon the wooden pins, round which the board is rotated. The cores for the steam and exhaust branches are made in solid boxes attached to the skeleton with bars, also whatever metal projections there may be in the cylinder are formed by bedding solid patterns into the core, such as ribs on the cylinder ends, supports for the astern turbine or other parts that require to be moulded by relieving out of the core, all such portions being removed after drying.



With the larger cores, where the interior cannot be made hollow, ashes are rammed in to form the vent, these may come to within two inches of the surface of the core extending the whole length to the prints, whence outlets are provided by means of tubes; the ashes are left sufficiently loose to allow of the gases penetrating and having easy egress.

In order to support the core in the mould or prevent it being floated upward by the pressure of the molten metal, chaplets of various forms are employed; the commonest is a flat-headed nail driven into the mould sand, leaving the head protruding for the required thickness of metal, the core resting upon this head; frequently three or four nails are riveted to a piece of hoop iron 8 or 9 inches long, these being made of varying heights to suit different thicknesses of metal, adjustable screw chaplets, both of wrought and cast iron, are also employed, or simply short lengths of hoop iron bent to channel or Z section to the necessary depth, all these usually being tinned to prevent corrosion.

Institute of Marine Engineers.—The Institute of Marine Engineers paid a visit to the testing works of Messrs. David Kirkaldy & Son Southwark Street, S.E., on Saturday afternoon, April 20th. The firm was founded by Mr. David Kirkaldy in 1866, and the present building was erected in 1873, being specially designed so as to be suitable for the operations to be carried on within. Before commencing the inspection of the works, one section of the party under the guidance of Mr. W. G. Kirkaldy, and the other conducted by Mr. A. J. Nash, the visitors passed into the private office, where great interest was shown in the coloured drawing of the steamship *Persia*, which was hung in the exhibition of the Royal Academy in 1861, being the first and only engineering drawing yet admitted to that institution. This was executed during his spare time by the founder of the firm, and the beautiful finish, delicate shading and extraordinary minuteness of the detail is a standing evidence of the mathematical exactness which characterized David Kirkaldy's work. Passing into the main testing room, a spacious room on the ground floor, the object which first commands the attention is the great hydraulic testing machine designed by David Kirkaldy, which plays a very important part in the work of the firm. It has a capacity of 270 tons and by the arrangement of various apparatus, its scope embraces a large number of different tests, including pulling or tensile, thrusting, bending or transverse, twisting or torsional, elastic stress, shearing and bulging tests. A piece of mild steel about 18 inches long by 2 inches by ½ inch was inserted, and the machine set in motion, the strain being communicated by a series of levers to a small machine at one side and recorded on a scale which, in this case, registered 70,000 when the steel broke. A wire testing machine, necessarily very much smaller was then set in operation, with a piece of ·072 binding wire in test, the indicator recording on a semi-circular scale a breaking strain of 795 lbs. Some neat little pats of cement which had been immersed in water for 28 days were now subjected to a tensile test in the cement testing machine. One of them was inserted so as to be firmly clutched top and bottom by two arms of the machine, and after the machine was balanced lead shot was gradually run into a tin on the opposite side, causing the upper arm to pull until the cement gave way. The manometer, a delicate instrument to measure the hardness of various metals, was then shown at work, the operation itself being apparently a very simple one, somewhat similar to a punching machine, a projection on the upper part of the machine causing a cup-shaped impression in the metal, the hardness of the latter being gauged by the depth of the impression. In the basement were machines for proving chains, testing cement, and testing the strength of drain pipes by bursting. On the first floor are situated various machine tools, lathes, planing, shaping, slotting and drilling machines, fitters' benches, with complete stocks of tools and standard gauges for the accurate preparation of such specimens as require it previous to their being tested. Great precision is aimed at and obtained, and the method and care with which specimens are prepared has gained a name for the establishment. A small impact testing machine is situate in this room. Here also was seen in course of preparation the gearing of a motor car, which had evidently been in difficulties, and reminders of more serious breakdowns were pointed out in the museums on the second and third floors, part of a column of the Tay Bridge which gave way in the disaster of 1880, a broken girder from the stand of the football club at Ibrox, which gave way some six or seven years ago, and one of the stays of the roof which collapsed at the Charing Cross Railway Station in more recent days. The museum also revealed the wonderful variety of work tested by Messrs. Kirkaldy, specimens of axles, rails, tyres, marine shafts, locomotive wheels, every description of steel, iron, brass, bronze, lead and other metals, wood of various kinds, stone ferro-concrete blocks, leather, drain pipes, wire ropes, nothing seems to have escaped their "dissecting knife." The record office and a laboratory used for private tests are situated on the first floor. The visit was very much enjoyed, and the courtesy of Mr. Kirkaldy and Mr. Nash and their readiness to explain and impart useful information much appreciated. After expressing the thanks of the Institute to these gentlemen the visitors left about six o'clock.

Toope's Asbestos Covering Co., Ltd., have supplied 17,000 feet of their various patent removable coverings to the Newcastle Workhouse; they have also just covered the piping and two large Lancashire boilers at Lanchester Union, Lanchester, with their celebrated removal asbestos mattresses, which orders they secured against all local competitors; they have now in hand, amongst other orders, 1,400 feet of covering at Notting Hill Electric Light Station and the whole of the covering at Ashford Schools, Ashford, comprising some 14,000 feet of sectional coverings, besides 20 dozen of their celebrated patent flange covers.

Thorn's School of Marine Engineering.—At the examination held on April 9th, 10th, and 11th, the following candidates were successful for Extra First-Class Engineer:— At North Shields, Messrs. A. Crichton and C. Stokoe, of Sunderland, and Mr. G. H. Nicholls, of Gateshead. At Leith, Mr. G. J. Newlands, of Edinburgh, and Mr. N. Dakin at London. Four of the above passed the first time up, Mr. Dakin being prepared entirely by the correspondence system of tuition introduced by Mr. Thorn. The above pupils make 152 successes in this grade from the establishment of Messrs. W. H. Thorn & Son, 5, Waterville Terrace, North Shields.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Transport.—On March 26th Messrs. R. Craggs & Sons, Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer 358 ft. 6 in. long, 50 ft. 8 in. beam, 25 ft. 6 in. depth moulded. This vessel is being built under special survey to Lloyd's three-deck rule with one deck laid, having poop, bridge and forecastle. Accommodation is provided for captain, officers and engineers in spacious deck houses on bridge and the crew in the forecastle. Cellular double bottom is fitted throughout for water ballast, also after peak, the total amount being about 1150 tons. Six powerful steam winches are provided of the most approved type, driven from a specially large multitubular donkey boiler. Steam steering gear is supplied and improved quick warping steam windlass is fitted forward. The arrangements for handling ship and cargo are most complete in every respect. The machinery will be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, and will have cylinders 25 in., 42 in., 68 in., by 45 in. stroke, steam being supplied by two large single-ended boilers working at 180 lbs. pressure to the square inch. The vessel has been built to the order of Messrs. Tremellen & Thomas, of 22, St. Mary Axe, London, E.C., and on leaving the ways was named *Transport* by Mrs. Tremellen. The specifications have been supervised and the construction of the hull and machinery superintended by Mr. W. O. Hughes and Captain Jones.

Llongwen.—On March 27th Messrs. Richardson, Duck and Co. launched from their yard at Stockton-on-Tees a steel screw steamer of the following dimensions :—Length overall, 383 ft. ; breadth extreme, 50 ft. 9 in. ; depth moulded, 30 ft. 3 in. ; gross tonnage, about 4750 tons. This vessel, which has been built to the order of The W. & C. T. Jones Steamship Company, Limited, of Cardiff, will class 100 A1 in Lloyd's Register, and has been built under special survey. She is of the three-deck type with one deck laid, and has cargo poop, bridge amidships and topgallant forecastle for crew, accommodation for captain, officers and engineers being fitted up in steel houses on bridge deck. A cellular double bottom throughout and peak tanks are fitted for water ballast, and equipment includes seven steam winches, horizontal multitubular donkey boiler, steam windlass with quick warping ends, stockless anchors, steam steering gear, etc., etc. The engines by Messrs. Blair & Co., Ltd., have cylinders 26 in., 42 in., 70 in. with a stroke of 48 in., steam being supplied by three single-ended boilers having a working pressure of 160 lbs. The hull and machinery have been constructed under the supervision of Mr. Geo. W. Wilson, owner's superintendent engineer. As the vessel left the ways she was christened *Llongwen* by Mrs. W. E. Jones, of Cardiff.

Carbineer.—On March 28th there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, a steel screw steamer built to the order of Messrs. Fisher, Renwick & Co's., Manchester, London Steamers, Ltd., of Manchester, and of the following dimensions, *viz.* :—Length, 228 ft. 6 in. ; breadth, 33 ft. ; depth, 17 ft., and to class 100 A1 at Lloyd's on the Awning Decked Rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including three double cylindered steam winches and three steam cargo hoisting engines, direct-acting steam windlass, donkey boiler, steam steering gear by Messrs. Donkin & Co., of Newcastle-on-Tyne, and Hastie's screw gear aft. The engines, which are supplied by Messrs. North-Eastern Marine Engineering Co., Ltd., are of the triple expansion type, having cylinders 17 in., 28 in., and 46 in. by 33 in. stroke, and working at a pressure of 180 lbs. On leaving the ways the vessel was named the *Carbineer* by Miss Elsie Fisher, of Higham, Bassenthwaite Lake, Cockermouth.

Pollacsek and **Grof Serenyi Bela.**—On March 28th Messrs. William Gray & Company, Limited, launched at West Hartlepool the two handsome steel screw steamers *Pollacsek* and *Grôf Serènyi Bèla*, which they have built for Messrs. The Atlantica Sea Navigation Company, Limited, of London and Budapest. They are sister vessels to the *Szterènyi* and *Magyarorszàg*, which were launched from the same yards four weeks ago. The saloon, state rooms, captain's, officers' and engineers' rooms, etc., will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull of each vessel is built with deep frames dispensing with hold beams and leaving large clear holds, cellular double bottom and large aft and fore peak ballast tanks, eleven steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large marine type donkey boiler, provision for shifting boards throughout, stockless anchors, telescopic masts, boats on beams overhead, electric light throughout, and a very complete outfit for a first-class cargo vessel. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 40 in., and 65 in. dia., with a piston stroke of 42 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. The ship and machinery have been built under the superintendence of Mr. D. M. Robson, of London, the owner's superintendent, and the ceremony of naming the steamers *Pollacsek* and *Grôf Serènyi Bèla* was gracefully performed by Mrs. Pollacsek, wife of the Director-General of the company, and Countess Serènyi.

Yarra.—On March 28th Messrs. Furness, Withy & Co., Limited, Middleton Shipyard, Hartlepool, launched the s.s. *Yarra*, built to the order of Messrs. Huddart, Parker and Co, Proprietary, Limited, Melbourne, Australia. She is over 300 ft. in length and takes Lloyd's highest class, and will be fitted out as a first-class cargo carrying vessel, having large hatchways and clear holds, which, together with a special arrangement of gaffs and steam friction winches, will facilitate quick loading and discharging necessary for the Australian coasting trade. The eight steam winches are worked from a large donkey boiler in recess forward of main boilers and exhaust back into large winch condenser in engine-room. A special steam ash hoist and also steam steering gear—in addition to hand gear aft—will be fitted. Both fore and after peaks are fitted up as ballast tanks in addition to a deep cellular double bottom all fore and aft. The crew will be berthed in topgallant forecastle and the officers and engineers in deck houses on the bridge deck. The engines and boilers will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Limited, Hartlepool, the sizes of cylinders being 23½ in., 37 in., 61 in. by 39 in. stroke ; two single ended boilers 15 ft. 3 in. diameter by 10 ft. 6 in. long, 180 lbs. working pressure. The vessel has been constructed under the personal supervision of Mr. W. Cumming, Dundee. The christening ceremony was gracefully performed by Miss Rachel Withy, Brantford, West Hartlepool.

Crown.—On April 8th there was launched by Mr. Edward Hayes, Stony Stratford, a steel harbour service launch 60 ft. by 11 ft., fitted with single compound surface condensing engines having cylinders 8 in. and 16 in. by 10 in. stroke, and large marine return tube boiler built under Lloyd's Survey for 120 lbs. working pressure. The boat was christened by Miss Grace Ainsley, and is for work in the West Indies, being specially fitted for that climate with extra ventilation and ample awning of teak.

Fleetwing.—On April 11th Messrs. S. P. Austin & Son, Limited, launched from their shipbuilding and repairing establishment at the Wear Dockyard, Sunderland, the steel screw steamer *Fleetwing*, which has been built to the order of Messrs. The John George Hill Steam Shipping Co., Ltd. (Messrs. Witherington & Everett, of Newcastle, managers). She is designed to carry about 2100 tons deadweight on light draught, will be classed 100 A1 in Lloyd's Register under special survey, and is specially adapted with large hatchways for quick loading and discharging coal cargoes, besides having large water ballast capacity. Electric lighting is also fitted in all accommodations and in cargo holds. Accommodation for captain and officers is provided in the poop, engineers in bridge house, and crew in fore part of bridge. The machinery will be supplied by the North-Eastern Marine Engineering Co., Limited, and the deck machinery, including steam windlass, by Emerson Walker & Thompson Brothers, Limited, steam winches by John Lynn & Co., Limited, steam steering gear by Donkin & Co., will be supplied with steam from a large multitubular donkey boiler made by the Blake Boiler Company, Darlington. The construction has been

carried out under the superintendence of Mr. Thomas Boulton, of Newcastle-on-Tyne, on behalf of the owners, and the vessel was gracefully named by Mrs. Ernest Hill, of Castle House, Horsell, Surrey, wife of the chairman of the company.

Kitty.—On April 11th Messrs. Scarr & Son launched from their Howden yard a steel lighter built to the order of Mr. Thomas Wilson, of Hull. The launch was witnessed by Mr. Wilson, jun., son of the owner, and Mr. Gray, superintendent. The vessel, as she left the ways, was christened *Kitty* by Miss Gray, daughter of the superintendent.

Leif.—On April 11th there was launched from the yard of the Sunderland Shipbuilding Company, Ltd., a steel screw steamer 285 ft. length between perpendiculars, by 43 ft. 6 in. broad, by 21 ft. 3 in. deep, having poop, bridge and topgallant forecastle, classed 100 A1 Lloyd's under special survey, single deck type. Accommodation is placed on the bridge for captain, officers and engineers, whilst the sailors and firemen are berthed in the forecastle as usual, the saloon is in a deck house at the fore end of bridge, and is fitted up in polished hardwoods, a large vertical donkey boiler is supplied for driving the deck machinery, which consists of six steam winches, steam steering gear and direct steam windlass. The main engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 22 in., 36½ in. and 60 in. by 39 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of Messrs. A. O. Andersen & Co., of Copenhagen, and during construction has been inspected by Mr. A. B. Kaempe on behalf of the owners. On leaving the ways the vessel was gracefully named *Leif*.

Oiz-Mendi.—On April 11th Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.* :—Length, 285 ft ; breadth, 41 ft. 9 in. ; depth, 18 ft. The vessel will be classed 100 A1 at Lloyd's, having main and quarter decks, break poop, bridge and topgallant forecastle. Accommodation for captain and officers in poop, engineers in houses on bridge deck, crew in the forecastle. The vessel has double bottom for water ballast on the cellular principle, and in after peak. She will be fully equipped with an up-to-date outfit, including quick warping steam windlass, stockless anchors, steam steering gear amidships, and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete, and include four steam winches, steam being supplied by a large donkey boiler. The engines will be of the triple expansion type by Messrs. Blair & Co., Ltd., of Stockton, of about 950 I.H.P., having two steel boilers 13 ft. by 10 ft., 180 lbs. steam pressure. The vessel has been built to the order of Messrs. Sota Y Aznar, Bilbao, and the christening ceremony was gracefully performed by Miss Ropner, Preston Hall, Stockton-on-Tees, who gave the vessel the name of *Oiz-Mendi*.

Elisabeth.—On April 12th Messrs. Craig, Taylor & Co., Limited, launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled single deck screw steamer of the following dimensions, *viz.* :—291 ft. by 38 ft. 4 in. by 20 ft. 7 in. She is built of steel to the highest class in Lloyd's, under special survey, and to Dutch Law requirements, and has poop, bridge and topgallant forecastle. She is equipped with patent steam windlass with quick warping ends, steam steering gear, five steam winches, suitable donkey boiler, pole masts fitted with gaffs, in addition to derricks, and all the latest improvements for rapid loading and discharging. The accommodation for captain and officers is neatly fitted up in deck houses amidships, the engineers being in deck house alongside engine casing and the crew in the poop. Her engines have been constructed by the North-Eastern Marine Engineering Co., Ltd., Sunderland, the cylinders being 19 in., 31 in., 51 in. by 33 in., with two large steel boilers working at 180 lbs. pressure. Wailes, Dove & Co.'s bitumastic enamel was applied to bunkers and boiler-room tank, and their bitumastic covering to the tank top in boiler space. The vessel has been built to the order of A. C. Lensen, Esq., of Terneuzjbi, under the superintendence of W. C. Carter, Esq., of London. As she left the ways she was gracefully christened the *Elisabeth* by Mrs. A. C. Lensen, wife of the owner. Messrs. Craig, Taylor and Co., Limited, have just laid the keel of a sister ship for the same owner.

Waihora.—On April 15th a steamer which is being built for the Union Steamship Co., of New Zealand, Ltd., was launched from the Neptune Works of Swan, Hunter and Wigham Richardson, Ltd. The launch was witnessed by a goodly number of spectators, and as the vessel left the ways she was named the *Waihora*, the christening ceremony being gracefully performed by Miss Geraldine Mills, daughter of the chairman of the Union Steamship Co., who was also present. The vessel is built of steel 385 ft. in length by 52 ft. beam, and is to carry a deadweight of 7500 tons on a light draught of water. She is being constructed under the survey of the British Corporation. Her propelling machinery will consist of a set of triple expansion engines which, together with their boilers, are also being constructed at the Neptune Works, and are expected to drive the vessel when fully loaded at a speed of 10¾ knots.

Wyoming.—On April 15th there was launched from the Southwick Yard of Messrs. Robert Thompson & Sons, Ltd., a steel screw steamer built to the order of Messrs. B. C. Atkinson & Son, of Middlesbrough. Her principal dimensions are—Length, 176 ft ; breadth, 29 ft. 10 in. ; depth moulded, 13 ft. She is classed 100 A1 at Lloyds. The erections consist of raised quarter deck, bridge amidships for the accommodation of officers and engineers, and topgallant forecastle for crew. There are three large hatchways worked by powerful steam winches by Clarke, Chapman and Co., Ltd., for the rapid loading and discharging of cargo. Quick warping steam windlass by Messrs. Emerson, Walker and Thompson Bros., Ltd., and steam and hand steering gear by Robert Roger & Co., Ltd. The engines are by Messrs. Richardsons, Westgarth & Co., Ltd., Middlesbrough, of the triple expansion type, having cylinders of 15½ in., 25 in., and 41 in. by 27 in. stroke, with two boilers of ample power. During construction the ship and her machinery have been personally superintended by Mr. James Summers, of Middlesbrough. As the vessel left the ways she was gracefully christened *Wyoming* by Mrs. Frank Atkinson, wife of the senior partner.

Kovno.—On April 16th there was launched from the yard of Earle's Shipbuilding and Engineering Co., Limited, Hull, a fine steel screw steamer, which has been built to the order of Messrs. Thos. Wilson, Sons, & Co., Limited. It is intended for the passenger and cargo trade between Hull and St. Petersburg, and will be a very valuable addition to the large fleet of steamers owned by the company. The vessel is 318 feet in length, 41 feet beam moulded, and 20 feet 11 inches in depth moulded, and has been built to British Corporation highest class and specially strengthened to withstand the severe wear and tear due to the large quantities of ice encountered in the Upper Baltic at the opening and closing of navigation. Triple expansion engines are to be provided by the builders, steam being supplied by two large steel boilers, designed to drive the vessel at a good speed on a minimum coal consumption. As the vessel left the ways she was christened the *Kovno* by Mrs. J. H. Fisher, of Willerby Hall. Among those present at the ceremony were Mr. J. H. Fisher, J.P., the Hon. C. Wilson, M.P., and Mr. Clive Wilson, D.S.O.

LAUNCHES—Scotch.

Chikugo Maru.—On April 3rd, there was successfully launched from the yard of Messrs. David and William Henderson & Co., Ltd., at Partick, a steel screw steamer, which they have built to the order of the Nippon Yusen Kaisha, Japan, through Messrs. A. R. Brown, MacFarlane & Co., Ltd., Glasgow, and under whose inspection the vessel has been built. The dimensions of the vessel are : length between perpendiculars, 310 ft., breadth moulded, 40 ft., depth moulded, 26 ft. 6 in., with a gross tonnage of about 2,530 tons. She is built to class 100 A1. Lloyd's spar deck class, and also in accordance with the Teishinsho rules. Accommodation is provided in staterooms under the fore part of bridge deck for a limited number of first-class passengers, and in addition there is a dining saloon and smoke-room in polished hardwood of a neat and tasteful design. Aft in the poop there is accommodation in rooms for 16 second-class passengers, with dining saloon, also in hardwood. Accommodation is provided in forward 'tween decks for third-class passengers. Captain, officers and engineers are berthed amidships and the seamen

and firemen forward. Special attention has been paid to the accommodation, all the rooms being large, airy and well ventilated. The vessel throughout is replete with everything that can add to the comfort of passengers and to the economical working of the vessel. The machinery has also been constructed by the builders, and consists of triple expansion engines, having cylinders 25 in., 41 in. and 68 in. diameter, by 48 in. stroke, and two large single ended boilers, working at a pressure of 185 lbs. On leaving the ways, the vessel was gracefully named *Chikugo Maru*, by Mrs. Edward Brown, Carisbrooke, Helensburgh. The *Chikugo Maru* is a sister ship to the *Chikuzen Maru*, recently launched by Messrs. Henderson for the same owners, and now nearing completion at their Meadowside Yard.

Egerton.—On April 3rd, Messrs. Wm. Simons & Co., Ltd., of Renfrew, launched the large twin-screw 1,200 ton pump hopper dredger *Egerton*, constructed to the order of the Crown Agents for the Colonies on behalf of the Lagos Government, for the improvement of the Port of Lagos. The construction of the dredger was carried out under the direction of Messrs. Coode, Son & Matthews, Civil Engineers, Westminster, London. The vessel is provided with a 27-inch sand suction pump driven from a set of triple expansion engines, capable of raising 2,500 tons of sand per hour from 35 feet below water level. The main suction pipe, 27 inches in diameter is fitted in a central bow well, and is controlled by powerful hydraulic gear fitted on upper deck. This pipe is connected to the suction pump and is fitted with an arrangement of flexible joints for preventing damage when the dredger is working on an exposed bar, the lower end of the pipe being so arranged that the vessel can plunge about without disturbing the nozzle on the ground. The vessel is propelled at nine knots speed by two sets of triple expansion engines, fitted with all the most modern appliances for efficiency and economy in working. Steam is supplied from two steel boilers of the Scotch type for 180 lbs. working pressure. An auxiliary condenser is provided for dealing with the exhaust steam from the auxiliary engines. The combined power of the propelling, pumping, and auxiliary engines on board is about 2,500 i.h.p. The hopper doors are raised by hydraulic rams arranged for rapid closing. Very strong windlasses are fitted at bow and stern and powerful capstans are placed aft for manœuvring purposes. Steam steering gear, electric light, cabins and crew's quarters, and all the latest improvements and appliances for this type of vessel are fitted up on board.

Glenmount.—On April 3rd, Messrs. Archd. McMillan & Son, Ltd., Dumbarton, launched the steel screw steamer *Glenmount*, which is the first of two vessels they are building for Canadian owners. The vessel, which is about 260 feet in length, is intended for service on the Canadian Lakes. Accommodation is provided forward for captain, with chart room on top of forecastle, while superior accommodation is provided aft for officers and engineers, the crew being berthed in forecastle. The machinery, which is fitted aft, is being supplied by Messrs. Muir & Houston, Ltd., Glasgow. The vessel and machinery have been built to Lloyd's highest class and under the superintendence of Mr. Dunlop, of Messrs. John Reid & Co., naval architects, Glasgow, and Captain Fraser, the owners' superintendent. The christening ceremony was performed by Mrs. Fraser, wife of Captain Fraser.

Kazembe. On April 10th, Messrs. Alex. Stephen & Sons, Ltd., launched from their yard at Linthouse, a steel screw steamer built to the order of the Bucknall Steamship Lines, Limited, London. The vessel has been built to Lloyd's 100 A1. spar deck class, and her dimensions are: length, 400 ft., breadth, 50 ft., and depth, 29 ft. 10 in. She has been designed to carry 7,500 tons deadweight on a moderate draught of water, and is fitted for carrying a large quantity of water ballast in the double bottom and peak tanks. She is fully equipped with derricks and steam winches for the quick handling of cargo, and has deep 'tween decks for the reception of bulky goods. The machinery, which is also being constructed by Messrs. Alex. Stephen & Sons, Ltd., consists of a set of triple expansion engines having cylinders 26 in., 44 in., and 73 in. in diameter, with a stroke of 48 inches. Steam at 180 lbs. working pressure will be supplied by three large single-ended boilers, fitted with Howden's Forced Draught. The vessel was named *Kazembe* by Mrs. J. W. Anderson, wife of Captain Anderson, who represented the owners at the launch.

Terawhiti. On April 16th, Messrs. Ramage & Ferguson, Ltd., launched a steel screw steam tug, which they have built to the order of the Union Steam Ship Company of New Zealand, Ltd. The dimensions of this vessel are: length, 120 ft., breadth, 20 ft. 6 ins, and depth moulded, 12 ft. 6 ins., and the propelling machinery consists of a powerful set of triple expansion engines, supplied with steam from a large boiler working at a high pressure. In addition to the usual tug's outfit, there is fitted a Merryweather boiler and large centrifugal pump for fire extinguishing and salvage work. The equipment is unusually complete for a vessel of this class and comprises steam steering gear, steam windlass, steam warping capstan aft, steam winch and electric light installation. The vessel has been built to the highest class of the British Corporation, and will have a Board of Trade Passenger Certificate. On leaving the ways, the tug was named *Terawhiti* by Mrs. A. G. Ramage, 8, Western Terrace, Murrayfield, Edinburgh.

TRIAL TRIPS.

Allan.—The S.S. *Allan*, built by Messrs. Mackay Bros., Alloa, and engined by Messrs. Hutson & Sons, Glasgow, to the order of Mr. Julius Christensen, Aarhus, Denmark, has just completed a very satisfactory trial trip, attaining a speed of 11¾ knots, with an indicated horse power of 1000. The vessel is 230 ft. by 34 ft. by 18 ft. 2 in., and has a carrying capacity of 2000 tons deadweight on Lloyd's summer draught. She has been specially designed for coal cargoes, and is fitted with all appliances for rapid handling of same, large self-trimming hatches are arranged for, and masts constructed so that vessel can be discharged by mechanical diggers on quay. Four powerful winches, steam windlass, and steam steering gear are provided. Her propelling machinery consists of triple expansion engine having cylinders 18 in., 30 in., 48 in. by 33 in. stroke, and supplied with steam from a single ended boiler 16 ft. by 10 ft. 6 in., working at 180 lbs. pressure. A Cochran donkey boiler is provided for cargo purposes. The vessel is fitted throughout with electric light, the dynamo being wrought by an oil motor. On board at trial were Mr. Julius Christensen, Mr. Powell, of Messrs. Alfred Christensen & Co., Mr. Fisher, Messrs. Peter and Donald Mackay, Mr. Peebles, of Messrs. Hutson & Sons, and Mr. D. M. Wallace, of Messrs. Wallace & Co., naval architects, consulting engineers and surveyors, London and Glasgow, under whose superintendence the vessel and her machinery has been constructed.

Daisy.—On March 19th the fine steel screw steamer *Daisy* (of which we gave particulars in our March issue, page 308), built by Messrs. Wood, Skinner & Co., Ltd., Bill Quay-on-Tyne, to the order of Mr. Martin Carl, of Copenhagen, left the Tyne for her official trial trip. The machinery, which has been constructed by The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple expansion engines, having cylinders 17½ in., 29 in. and 48 in., with a stroke of 33 in., steam being supplied by a large steel boiler working at a high pressure. The vessel encountered very heavy weather during the run off the measured mile, but notwithstanding same the engines worked without the slightest hitch throughout and maintained a speed of over 10 knots, which was considered very satisfactory by all present, amongst whom were Mr. Martin Carl, junr., Mr. Matzen, of Copenhagen, Capt. Larsen, under whose supervision the vessel has been constructed, Mr. Leslie Skinner, representing the shipbuilders, and Mr. J. Daglish, representing the engine builders.

Komata.—On March 21st the S.S. *Komata*, which has been been built by Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works, ran a very successful trial trip. This steamer has been constructed for the New Zealand service of the Union S.S. Co. of New Zealand, Ltd. She is 295 ft. in length by 42 ft. beam, and will carry over 3100 tons deadweight on a light draught of water. She is fitted with triple expansion engines and boilers, which have been constructed at the Neptune Works, and which on the trial trip worked with perfect smoothness, giving satisfaction to all concerned, and driving the vessel at a speed of over 11 knots per hour. The arrangements for working the vessel and for

loading and discharging her cargo are of the most complete and modern description, including eight steam winches, steam steering gear, steam windlass, etc., etc. The owners were represented on the trial trip by Mr. J. R. Campbell, of Glasgow, their naval architect, Mr. Wallace, engineer, and Mr. Paterson, under whose superintendence the vessel has been built, while the builders were represented by Mr. G. F. Tweedy.

Ryde.—On March 21st the S.S. *Ryde*, built by the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, and owned by Messrs. Rowland & Marwood Steamship Co., Ltd., of Whitby, was taken for her trial trip. This vessel is 360 ft. by 50 ft. by 25 ft. 8 in. moulded, and is designed to carry a cargo of over 6000 tons on very light draught. She is one of the builders' latest type of beamless light draught cargo steamers, and is specially designed without hold beams or pillars at the side of the hatches so as to give large, clear and uninterrupted holds for the storage of bulk cargo. The engines by Messrs. John Dickinson & Sons, Ltd., of Sunderland, have cylinders 24 in., 40 in. and 66 in. by 45 in. stroke with two large single-ended boilers and on the trial these worked excellently and to the satisfaction of everyone on board, the vessel maintaining an average speed of 11 knots over a number of runs. On the trial the owners were represented by Capt. Storm and Mr. Wright, the engine builders by Mr. Bowden and the shipbuilders by Mr. G. F. Mulherion and Mr. J. Bourn.

Sygna.—On March 23rd, the s.s. *Sygna*, of which we gave particulars in our March issue, page 308, built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesbrough, to the order of Herr J. Ludwig Mowinckel, of Bergen, proceeded to sea for her official trials. The engines are placed right aft and will give a speed of fully 11 knots average at sea. The vessel is specially adapted for the requirements of the Charter of the Dominion Steel Co., Ltd., of Sydney, Nova Scotia, and will be employed in carrying iron ore from Belle Isle, Newfoundland, to their steel works at Sydney.

Onward Ho.—On March 25th, the trial trip of the steamship *Onward Ho* took place. This fine vessel, built by Earle's Shipbuilding and Engineering Co., Ltd., to the order of Messrs. S. T. White & Co., Ltd., Hull, will be one of the largest engaged in trawling from Hull and is of the following dimensions: 143 ft. 4 in. B.P., 23 ft. extreme by 13 ft. 4 in. moulded. She presents some new features both in accommodation for crew and gear for handling tackle. The trials were made on the measured mile at Withernsea and a speed of 11 knots was attained in spite of the unfavourable weather. Further interest was added by the ship proceeding to sea and when about ten miles from the shore the net was shot and a very satisfactory haul of fish was obtained. A number of gentlemen interested in this ship were on board, and the owners were represented by Messrs. White & Langley, the engine builders by Mr. Brackenbury, of Amos & Smith, and Earle's Company by Mr. J. A. Sturrock.

Barbados.—On March 27th, the trial trip of the steam fleeter *Barbados* (of which we gave particulars in our April issue, page 351), took place. This vessel was severely tried by the strong wind and sea, and her behaviour presaged the reputation which her sister ships have earned, this vessel being the seventh built and engined by Earle's Shipbuilding and Engineering Co., Ltd., for the Hull Steam Fishing and Ice Co., Ltd. The owners were represented by Messrs. Richardson and Beath, and Earle's Company by Mr. J. L. Read

Hunter.—On March 26th, the twin-screw steamer *Hunter* (of which we gave particulars in our March issue, page 310), built by Ramage & Ferguson, Ltd., Leith, for the Newcastle and Hunter River Steamship Co., Ltd., Sydney, New South Wales, ran her official trials on the Firth of Forth. The vessel, which presents a number of novel features, among which are water tube boilers of the Babcock, Wilcox make, has aroused considerable interest and a large number of gentlemen engaged in various branches of engineering were present. The trials were most satisfactory and a speed of 14½ knots was maintained on a fifty miles' run. The vessel is now loading at Leith and will sail in the course of a few days for Sydney, under the command of Captain Warne.

Chyebassa.—On March 27th, the new steamer *Chyebassa* (of which we gave particulars in our March issue, page 311), left the Belfast Harbour and steamed down the Lough for adjustment of compasses, after which she proceeded to the Clyde to undergo her speed trials over the Skelmorlie measured mile course. The *Chyebassa* has been built by Messrs. Workman, Clark & Co., Limited, Belfast, for the British India Steam Navigation Company.

Fitzclarence.—On March 28th, the large steel screw steamer *Fitzclarence* (of which we gave particulars in our March issue, page 309), built by R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough, for Messrs. Burrell & Son, of Glasgow, proceeded to sea for her official trials. The results were pronounced entirely satisfactory to all concerned, the vessel registering an average speed of 13 knots over an eight-mile course.

Magyarorszag.—On March 28th, this handsome screw steamer (of which we gave particulars in our April issue, page 351), which has been built by Messrs. Wm. Gray and Co., Ltd., for Messrs. The Atlantica Sea Navigation Company, Limited, of London and Budapest, had her trial trip, when the performance of both ship and machinery was entirely satisfactory, the average speed of the vessel being 11 knots. On the conclusion of the trials the vessel proceeded to Cardiff to load. Messrs. S. T. Taylor & Sons, of Newcastle-on-Tyne, have covered the boilers, etc., with their Tynos non-conducting material and boiler bottoms with their Tynos patent removable asbestos mattresses.

Chikuzen Maru.—On April 11th and 12th the S.S. *Chikuzen Maru* (of which we gave particulars in our March issue, page 310), built by Messrs. David & William Henderson & Co., Ltd., at Partick, to the order of the Nippon Yusen Kaisha, Japan, through Messrs. A. R. Brown, MacFarlane & Co., Ltd., Glasgow, and under whose inspection the vessel was built, underwent successful trials on the Firth of Clyde. On the 11th the speed trials were run and a mean speed of 14½ knots was easily attained. On the 12th the coal consumption trials passed off successfully, and everything was highly satisfactory to the owners' representatives and builders.

Steam Launch.—On April 18th, a most successful trial trip was run by a Steam Launch, lately built for the West Indies. Her size is 60 ft. long, 11 ft. wide, draught about 4 ft. She is fitted with a standard set of "Haye's" compound surface condensing engines, 8 in. and 16 in. by 10 in. and large marine return tube boiler supplying steam at 120 lbs. per square inch; built under Lloyd's Survey, her average speed with and against the tide through four runs was slightly over 13½ miles, an exceptionally good performance considering the tide was nearly at its lowest. Several well-known gentlemen were present representing the Railway & Works Co., London, for whom the vessel has been built, also the Government inspector and the designer and builder, Mr. Hayes, of Stony Stratford.

Grof Serènyi Bela.—On April 20th, the handsome steel screw steamer *Grôf Serènyi Bèla* had her trial trip in Hartlepool Bay. This vessel is the third built by Messrs. Wm. Gray & Co., Ltd., for Messrs. The Atlantica Sea Navigation Co., Ltd., of London and Budapest. She has been built to the highest class in Lloyd's Register, and is of the following dimensions:—Length over all, 342 ft.; breadth, 48 ft. 3 in.; and depth, 24 ft. 6 in. She has extra long bridge, poop, and topgallant forecastle. The saloon, state rooms, captain's, officers' and engineers' rooms, etc., are fitted up in houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep frames, dispensing with hold beams and leaving large clear holds, cellular double bottoms, and large aft and fore peak ballast tanks. She carries a very complete outfit for a first-class cargo vessel. Triple expansion engines have been supplied from the Central Marine Engine Works of the builders, having cylinders 24 in., 40 in. and 65 in. diameter, with a piston stroke of 42 in., and two large steel boilers adapted for a working pressure of 180 lbs. per square inch. The average speed was 11½ knots, the performance of ship and engines being entirely satisfactory.

Norman.—On April 22nd, Messrs. Osborne, Graham and Co., sent to sea for her official trial trip the steel screw steamer *Norman* (of which we gave particulars in our April issue, page 350). The vessel has been specially constructed by them for Julius Christensen, Esq., Aarhus, Denmark. During the trial everything was satisfactory, a speed of over 10 knots being easily attained.

Annetta.—On April 20th, the steamship *Annetta* (of which we gave particulars in our April issue, page 352), built for the Donald Steamship Co., Ltd., by Swan, Hunter & Wigham Richardson, Ltd., Wallsend, to run in the fruit service of the United Fruit Co., between the West Indies and United States ports, was taken to sea for her trial trip, when speed attained was 12¾ knots. This is the fourth vessel the builders have constructed for the same company.

Makambo.—On April 13th, the s.s. *Makambo* (of which we gave particulars in our April issue, page 353), built and engined by the Clyde Shipbuilding and Engineering Co., Port Glasgow, ran her trials on the Clyde very successfully, when a speed of 11½ knots was obtained. The toast "Success to the *Makambo*" was proposed by Mr. Mackie, who referred to the great enterprise which had characterised the firm of Burns, Philp & Co. They had carried the British flag to islands of the Pacific and established a trade which merited recognition, not only in commercial return, but on patriotic grounds. Mr. Campbell responded. The toast of "the Builders" was proposed by Mr. Jas. Macartney and responded to by Mr. Bremner. She was built for Messrs. Burns, Philp and Co., the well-known firm of Australian merchants and is intended for developing the trade between Sydney and the New Hebrides, and she has been specially designed for the purpose. The *Makambo* sailed for Sydney on April 18th, *via* Singapore and Penang.

The Directory of Shipowners, Shipbuilders, and Marine Engineers for 1907. London: The Directory Publishing Co., Ltd.

This is the 5th issue of this work, which normally increases in size year by year, fifty-six pages being added to this issue. That there is a want for a work of this character is proved by the success which this publication has attained, and which we think is likely, from the nature of things, to be still further promoted as time goes on. The names of firms engaged in the industry are classified first in a general index, and next in the order of towns. With this general introduction we have the list of shipowners, commencing with the British Admiralty officers, Board of Trade, Lloyd's and other registration societies and their surveyors. The shipowners forming the bulk of these pages are arranged alphabetically, with lists of ships, tonnage, speed and builders' names, after each vessel. The second main section relates to construction in the list of shipbuilders and marine engineers, and opens with the Royal Dockyards and names of officers, the various works following in alphabetical order. Another index added last year is that of the boats themselves, the names of their owners following. Next comes a personal index of partners and chief officials of the several companies found herein. With the difficulties attending the forming a directory of this all-round character we think there is little to be found fault with, but we do not see why firms should be arranged according to their Christian rather than their surnames, which anyone would undoubtedly look for. Yet this is the case here, admitting, it seems to us, of any easy remedy.

BOARD OF TRADE EXAMINATIONS.

Note—1C denotes First Class; 2C Second Class.

March 23rd, 1907.

Adamson, David 1C Leith
Barker, R. J. B. 1C Liverpool
Bowen, John V. 2C Cardiff
Brown, William 2C N.Shields
Butt, Arthur R. 2C South'ton
Cain, Benjamin 2C Liverpool
Clark, Robert .. 2C N.Shields
Clarke, F. P. .. 1C W. Hart'l
Connell, M. F. 2C Glasgow
Cooper, John .. 2C Cardiff
Cowie, David .. 1C Leith
Davies, John T. 2C London
Dunsmuir, Robt. 1C Glasgow
Elliott, H. C. .. 2C W. Hart'l
Forsyth, D. J... 2C Leith
Gardiner, John 1C Glasgow
Givens, John E. 2C N.Shields
Green, Leonard 1C London
Griffiths, T. J... 1C Cardiff
Hall, James W. 2C Glasgow
Hamilton, Alex. 2C Glasgow
Hampton, Wm. 2C Leith
Harris, Albert.. 2C N.Shields
Holness, S. E.. 2C N.Shields
Howey, John S. 1C N.Shields
Ibbotson, R. W. 2C N.Shields
Johnson, G. W. 1C N.Shields
Jones, Wm. T. 2C Liverpool
Keady, Ernest . 2C W. Hart'l
Key, Corsar.... 1C Leith
Kickland, Hugh 1C London
Luff, Arthur S. 2C Cardiff
Lundie, David 1C Leith
Marks, Edward 2C Liverpool
Martin, Thomas 2C Liverpool
Martin, Geo. W. 1C Leith
Masson, John A. 2C N.Shields
McNivon, H. H. 1C London
M'Donald, R... 1C Glasgow
M'Donald, N. C. 2C Liverpool
M'Donald, R... 1C Leith
M'Ewing, John 2C Glasgow
Morgan, John C. 1C Cardiff
Morton, James 2C Glasgow
Morris, Syd. P. 2C London
M'Nair, T. R... 2C Liverpool
Perry, Thomas 1C Glasgow
Phillips, R. W 1C Cardiff
Pratt, Robert .. 1C London
Preece, Wm G 2C Cardiff
Prior, Leslie G. 2C Liverpool
Purdy, Edward 1C Cardiff
Reid, Alexander 2C Liverpool
Rimmer, T. W. 1C Liverpool
Ross, Charles .. 2C London
Smith, James .. 2C N.Shields
Stewart, Wm... 1C Glasgow
Stuart, George . 2C Glasgow
Stubbs, H. M... 1C Liverpool
Taylor, Edwin 1C Cardiff
Taylor, James.. 1C Glasgow
Thomas, R. A. . 1C Liverpool
Trevillion, J. W. 2C Plymouth
Wallace, R. D. 1C Glasgow
Williams, D. G. 1C Cardiff
Wilson, Wm. R. 2C W. Hart'l

March 30th.

Almond, H. C. . 1C London
Baxter, Geo W. 1C Sunderl'd
Bell, Arthur P. 2C N.Shields
Brown, Joseph . 2C N.Shields
Cotton, Arthur 2C Hull
Cummins, C. .. 1C Liverpool
Dawson, Thos. 1C Sunderl'd
Dawson, Jos. T. 2C N.Shields
Duncan, John .. 1C Liverpool
Eadie, Donald . 1C London
Evans, William 2C Liverpool
Fender, Syd. A. 1C Bristol
Forrest, John .. 2C N.Shields
Ford, Sydney H. 2C Hull
Freeman, H. A. 2C Hull
George, H. M. . 1C Aberdeen
Gibson, Thos. S. 2C Sunderl'd
Gillespie, Robt. 1C London
Griffin, Jos. C. . 2C Liverpool
Houghton, Cecil 1C Greenock
Howard, Joseph 2C Hull
Howatson, J. W. 2C N.Shields
Jones, Philip T. 2C London
Kidskup, J. R. . 2C N.Shields
Laudrey, C. W. 2C Dover
Macmillan, A. . 1C Greenock
Mail, John S... 2C Sunderl'd
Maitland, John 1C Liverpool
Martin, A. S. .. 2C Aberdeen
Mason, John J. 2C Sunderl'd
Mathieson, L. . 2C Greenock
M'Donald, A. T. 2C London
M'Intyre, James 2C London
M'Kenzie, David 2C Greenock
Moore, John H. 1C Liverpool
Patterson, J. H. 2C Aberdeen
Pickthall, F. J. . 1C London
Ross, Ralph A. 2C N.Shields
Singer, William 1C Aberdeen
Stuart, John H. 2C N.Shields
Thomas, Sidney 1C Bristol
Thompson, Jos. 2C N.Shields
Williams, E. A. 2C Liverpool
Williams, W. G 1C London
Woolford, F. J 1C Bristol
Wright, P. D. . 2C Sunderl'd

April 6th.

Allan, Frank .. 2C N.Shields
Anderson, J. W. 2C London
Atkins, Reg. W. 2C London
Barr, John .... 2C Glasgow
Bodley, George 2C Liverpool
Bowler, John F. 2C London
Bradley, James 2C N.Shields
Brown, R. K. .. 2C Glasgow
Brown, J. MacD 1C Glasgow
Cadwallader, Peter A. 1C Glasgow
Carney, Wm. V. 2C Cardiff
Cavender, W. B. 1C Belfast
Coates, Jas. L. . 2C N.Shields
Denholm, David 1C London
Edgeley, Henry 2C Glasgow
Evan, George J. 1C Cardiff
Fleming, Wm. . 2C South'ton
Flook, Samuel . 1C Cardiff
Grandfield, J.H. 2C Cardiff
Greig, James K. 1C London
Harrow, T. W. 2C Liverpool
Herbert, H. W. 1C Cardiff
Hill, James N. . 1C Glasgow
Hitchinson, R. . 2C N.Shields
Hollins, Evelyn 2C Liverpool
Kirkland, James 2C Liverpool
Livingstone, A. 2C Glasgow
Macdonald, K M. 2C Glasgow
Mackenzie, R.A. 1C London
Manning, E. S. 2C South'ton
M'Donald, M.. 2C Glasgow
M'Donald, J. B. 2C Leith
M'Dougall, A.A. 1C London
Miller, Thomas 2C Glasgow
Mulholland, D. 1C Belfast
Ovenden, G. H. 1C Cardiff
Pring, John H. 2C Cardiff
Riley, Adam .. 1C Belfast
Ritchinson, R. 2C N.Shields
Roberts, A. J... 1C London
Runciman, C... 1C Glasgow
Slater, Alex. .. 1C Glasgow
Smith, Ed. F... 1C N.Shields
Stewart, A. B. . 2C Leith
Tanner, Alf. R. 1C Cardiff
Tatton, Robert 1C Belfast
Thomas, John L. 2C Cardiff
Trail, John E... 2C Cardiff
Watt, John R. . 2C Liverpool
White, David J. 2C Liverpool
Wilkie, Geo. M. 1C Glasgow
Williams, Jos. . 2C Liverpool
Williams, Oliver 1C Cardiff
Wilson, John .. 2C Glasgow
Young, Hugh L. 2C Glasgow

April 13th.

Bennett, H. W. 2C London
Clark, Robert .. 2C Greenock
Cutbill, W. J... 2C Liverpool
Freer, Wm. E. . 2C Liverpool
Grant, Joseph.. 2C London
Harper, George 1C Liverpool
Hilton, G. M. B. 1C London
Hoggan, T. A. H. 1C Liverpool
Howell, Roger . 1C Liverpool
Jordan, Jas. E. . 2C Hull
Lumsden, J. T. 2C Greenock
Matthew, N. M'L. 1C London
Murdoch, W. M. 1C Greenock
Ozamis, Martin 1C Liverpool
Paton, R. M'K. 1C London
Price, Herbt. E. 1C Hull
Roberts, Herbt. 1C Hull
Ruth, Andrew P. 1C London
Weeks, Albt. T. 1C London

The Marine Engineer

And Naval Architect.

LONDON, JUNE 1, 1907.

THERE is an impression abroad that the conferences which brought Premiers and Representatives from the Colonies to London has not resulted in any practical issue. With this impression we do not agree, although no immediate apparent result may follow. The diversity of views which have been expressed during the conferences, both on Imperial questions and on Shipping legislation, has been so great that an average compromise meantime would be difficult to strike, and, indeed, undesirable as an immediate result, on the ground that hurried determination and hasty legislation—of which we have had not a few undesirable illustrations now and again—partake of the risk run by one who marries in haste and repents—if the hasty one survives, at leisure. There is, however, one particular ground on which all may meet and combine towards reaching a common understanding, and that is in connection with the Government surveyorships. These offices are filled by responsible men whose fitness depends upon certain qualifications, which are recognised throughout the Empire as depending upon generally approved lines, and, in most cases, do depend upon even definite and specifically detailed lines, both in respect to experience and examination, and acting under practically the same or similar regulations, made and carried out for the common good of all concerned to ensure safety and protection to life and property. Such being the case, it would appear that the certificate of attestation of all holding office in a special department should be recognised as valid throughout the Empire.

Thus a ship which is placed in Dry Dock in any port of the United Kingdom, and then proceeds to India or the Colonies, where it becomes necessary to comply with certain regulations depending upon the Dry Docking certificate, the Home certificate ought to be allowed to stand good when so required, as also should the Dry Docking certificate of Indian or Colonial Government surveyors. The shipowner is sometimes placed under great disadvantage and unnecessary expense by reason of the want of uniformity and interchangeability at present ruling, resulting in work being done twice over without any good and logical reason.

Uniformity of principle and action throughout the Empire would avoid vexatious delays and unnecessary expense falling upon the shipping industry, and on national and patriotic grounds this is the direction in which we ought to work out our position, removing stumbling blocks from the pathway of our sea-borne traffic.

The case of Dry Docking has been cited as an illustration, but there are others of similar import which come under the cognizance and jurisdiction of engineers and marine superintendents. The interchange of thought and opinion on matters Imperial among those representing views gained from experiences locally, with a view to facilitate Intercolonial trade and ocean traffic between all sections of the British Empire, is calculated to effect a good understanding on many points of difference and apparent hardship, which, more or less severely, place the shipping industry at a disadvantage. One step towards a common understanding and homogeneity in action might be taken in the direction indicated. Such a step would tend to pave the way for others, which at present are more than difficult to take, in connection with custom and tariff dues, and the like.

WHEN recently the question of Naval Works was under discussion in the House of Commons, the provision of docking accommodation for vessels of the *Dreadnought* and *Invincible* types was referred to. The particular point raised concerned the decision of the Government in regard to the development of Rosyth, and it seems to have been made clear that although it is not intended to spend any large amount this year on the development of the new naval base, yet the naval authorities have decided in favour of that place in preference to others which have been suggested. Primarily, no doubt, the question of comparative advantages as between one place and another as a naval base is strategical, and can only be decided by the naval authorities. On the other hand, the engineering questions involved are most important, both as regards the capabilities of the place selected for the establishment of a naval arsenal from many points of view, and also as regards the best and most expeditious manner and method of providing the necessary equipment. The money now being spent at Rosyth is very largely employed for the purpose of obtaining information as to the suitability of the foundation for carrying out reclamation works, afterwards to form the wharves and basins of the new establishment. It must be, however, many years before Rosyth can be made available, and even after the estimated expenditure of £2,300,000, it is probable that much more will be wanted to convert The Hope into a first-class naval dockyard. Similarly, and very often spoken of as an alternative, there is the provision of a new lock at Portsmouth, which is about to be constructed at a cost of £1,000,000. But by neither scheme is it likely that immediate wants in the matter of docking accommodation for the *Dreadnoughts* can be supplied. And meantime there are stories none too pleasant told of the risks recently taken in placing these huge vessels in dock.

About the growth of our requirements in regard to docking accommodation there can be no doubt, and as the tendency is to increase the size and weight of our ships, so will our requirements in this respect tend to increase. So far as home waters are concerned, it has been officially admitted by Mr. Lambert, on behalf of the Admiralty, that there is only one dock at Portsmouth theoretically capable of accommodating the *Dreadnought*, although there are four at Keyham of sufficient capacity. On the east coast there are no docks, except those in private hands. Sir Charles Dilke, who has given much study to this subject, insists that there must either be an enlargement of the accommodation at Chatham, or a new dockyard on the east coast, either Rosyth or some other. He argues that it would be dangerous to rely almost exclusively on Portsmouth or Keyham, because of the floating mines that may be laid in the Channel. There is no reason, however, why floating mines should not as easily be laid in the North Sea, and this particular form of menace, therefore, will affect the Rosyth scheme as much as it does the ports in the Channel. Moreover, there is no great difference in distance from the area of possible action between Rosyth and Keyham, and it has been suggested that it would be more useful to construct a base at Caithness than at any place lower down the coast. Wherever it may be decided to provide additional docking accommodation, whether in the Orkneys, at Rosyth, or at Sheerness, the nearest of all, the question of using floating docks must surely arise. Within the last few years the increase in size of floating docks has been most marked, and as compared with masonry docks there are advantages both in economy and in the celerity with which the former can be provided. It was not so long ago, when the largest docks in use were only capable of lifting about eight thousand to ten thousand tons, but now, from twenty to thirty thousand tons are in use, and even those of greater lifting power are in contemplation. The Dewey Dock has a lifting power of twenty thousand tons, and the Bermuda Dock almost as much, the latter only the other day lifting the Dominion, of over sixteen thousand tons displacement. A dock is now being built at Hamburg, which, it has been stated, could lift two Dreadnoughts at once, would have a life of at least forty years, and would cost under £200,000. Such a dock, or two of them, at Sheerness could be provided in one seventh of the time it would take to build an ordinary granite dock, and possibly less, because the bottom of the Medway, like that at Rosyth, would need supporting by some system of floating or fixed foundation. As the question stands at present, it is evident that it needs some exhaustive consideration, and should be studied, not only in the light of strategic requirements, but also in its engineering aspect.

THE SCREW PROPELLER.

XI.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

TRIAL trip errors, due to tidal effects, are generally more serious at the lower speeds, as may be seen by the following, which are the results of three runs with the ship travelling through the water at a real speed of 8 knots, and three runs at 6 knots, made after the completion of the twelve runs at full speed, the tide was beginning to slacken at their completion, and the last few runs of this set were at and after high water.

No.	Speed on M. Mile.	1st Mean	True Mean
13	9·45	8·388	
14	7·32		8·072
		7·755	
15	8·19		
16	6·02		
		5·770	
17	5·52		6·125
		6·480	
18	7·44		

In both cases the error is serious from a scientific point of view, and the latter so much so as to vitiate calculations based on the results of such a set of trials. A trial trip course, with little or no tide, is therefore most desirable, or even better still, one with a current running always one way at a uniform rate.

The effect of variation in diameter of screw only was illustrated by taking hypothetical cases and calculating the results, without regard to the effect of the ship on the screws—in other words, neglecting the augmented resistance due to a propeller placed in *wake* of the hull, and the *wake* currents of the ship herself on the screw.

In 1849 a series of trials were made by the Admiralty, with H.M.S. *Archer*, a sloop 186 ft. long, 33·8 ft. beam, and 14.1 ft. draught of water; the displacement being 1240 tons, the immersed area of mid section 371 sq. ft., and the prismatic co-efficient 0·629. She was, in fact, a ship of the same class, but a trifle larger than, H.M.S. *Rattler* and *Greyhound*. She was, however, fitted with a screw which, while having a pitch of only 7·75 ft., had originally a diameter of 12·5 ft., and consequently a pitch *ratio* so low as 0·62. At 71 revolutions the speed was only 6·39 knots, with 199 I.H.P., whereas the *Rattler*, with her 10 ft. screw, did 8 knots with 205 I.H.P. The hull resistance horse power, at 6·4 knots, was only 74, so that 125 I.H.P., or 63 per cent., was used up in engine friction and other losses, as propeller friction and augmented resistance. The screw, after this trial, was reduced in diameter bit by bit till it was down to 9 ft., and the

* For Articles I. to X. see August to May issues.

surface of blades 26·4 sq. ft., as against the 48 sq. ft. of the original; the speed with this propeller was, however, 7·818 knots, with 347 I.H.P. and 110 revolutions. The hull resistance horse power for this speed, as also deduced from the *Greyhound* trials by Froude, is 134, which points to a loss from engine friction, etc., of no less than 213 I.H.P. or 61·4 per cent., or very little less than that with the larger increase in pitch; consequently, there was at each step an increase in revolutions (trial B has the appearance of being faulty in more ways than one). The increased revolutions would, in these early engines, produce a rapid increase in engine resistance, as may be seen by the estimate of it; and by comparing I.H.P. with Propeller H.P. it would seem as if the loss was greater still. Judging the screws by sub-

TABLE XVII.

TRIALS OF H.M.S. "ARCHER," WITH SCREW PROPELLERS OF DIFFERENT DIAMETERS, ON THE THAMES, IN 1849.

No. of Trial	A.	B	C	D	E.
Diameter of Screw .....ft.	12·5	11·62	10·0	9·0	9·0
Pitch do. do. .....ft.	7·75	7·75	7·75	7·75	7·25
Surface of Blades.....sq. ft.	48·24	41·20	31·80	26·40	28·50
Pitch Ratio	0·620	0·666	0·775	0·860	0·806
Revolutions per minute	71·01	72·99	98·77	110·2	126·17
Slip per cent. of Screw	17·68 NEG.	10·2 NEG.	0·45 POS.	7·24 P.	13·59 P.
Speed of Ship .....knots	6·390	6·151	7·520	7·818	7·800
Indicated Horse Power	199	206	294	347	420
Do. Thrust.....lbs.	11940	12015	12686	13400	15200
Calculated Thrust ..... ,,	5820	5000	6000	5770	6400
Resistance of Ship's hull ..... ,,	3785	3508	5244	5587	5540
Augmented Resistance ..... ,,	2035	1492	756	183	860
Resistance Horse Power (R.H.P.)	74·2	66·6	119·6	134·1	133·0
Propeller Friction do. do.	34·7	26·0	32·4	27·8	44·5
Engine do. do. do.	49·9	52·1	87·4	108·3	143·0
Horse Power delivered by Screw	114·0	94·4	142·0	138·5	153·0
Displacement $^{2/3}$ × Speed^3 ÷ I.H.P.	151·7	130·1	166·0	159·0	133·9
Do. do. do. ÷ P.H.P.	205	284	343	397	368
General Efficiency R.H.P. ÷ I.H.P.	0·372	0·325	0·407	0·387	0·317
Engine do. P.H.P. ÷ I.H.P.	0·572	0·458	0·483	0·400	0·364

TABLE XVIII.

LONG VOYAGE TRIALS, WITH SCREWS OF DIFFERENT DIAMETERS (1878).

	ss. ALPHA.		ss. BETA		ss. GAMMA.	
	LARGE	SMALL.	LARGE.	SMALL	LARGE.	SMALL
Diameter of Screw .....ft.	23·5	21·0	23·5	21·0	21·5	20·0
Pitch do. mean..... .....ft.	30·0	29·5	30·0	29·5	31·0	28·0
Surface of Blades .....sq. ft.	124	153	124	153	128	124
Pitch Ratio	1·277	1·405	1·277	1·405	1·442	1·400
Revolutions (average)	52·5	54·8	51·8	55·0	46·0	52·6
Slip per cent. do.	9·10	6·40	11·1	9·7	9·1	7·0
Speed do. ..... knots	14·6	14·9	14·6	15·1	12·7	13·2
Coal Consumption (total)	1876	1765	1759	1696	1496	1344
Do. Saved by Small Screw		111		63		152
Do. do. per cent. do. do.		5·9		3·6		10·1
Gain in Speed per cent. by Small Screw		2·05		3·43		3·94

screw. It will also be seen by reference to table XVII. that the Admiralty co-efficient from the D trial was only 159, which is very poor, and that of the A trial is even less, *viz.*:—151·7. A closer investigation is necessary therefore if any useful differentiation is to be obtained from these trials. It will be noticed that each decrease of diameter was concurrent with a corresponding decrease of surface of blades, but no stituting P.H.P. for I.H.P. in the Admiralty formula, the high co-efficient of 397 of trial D, indicates that the 9·0 ft. screw with 7·75 ft. pitch, as a propeller alone, was the most efficient; and that with 9·25 ft. the next in value. Why so foolish a thing should have been perpetrated as the making of the new screw following these trials, of a less pitch, is difficult to conceive, and to-day impossible to explain. Had

the new screw been made with 10 ft. pitch, so as to have brought the revolutions back to about 90, it would have been a much wiser thing, and be consonant with the lesson learnt with the *Rattler*.

Perhaps, however, after all the most interesting, and possibly the most instructive information obtained from the *Archer's* trials is the effect of pitch ratio on the slip of the screw, for the evidence thus afforded will be found most useful when considering the existence and cause of the so-called negative slip. In these early days of screw propulsion we find the *Archer* showing negative slip, and very largely so, for on the A trials, with a screw having a pitch ratio 0·62, it was as much as 17·68 per cent; with a screw with a larger pitch ratio (0·666) the slip decreased to 10·19 per cent., while with a further increase in pitch ratio (0·775) the slip was slightly positive (0·45 per cent).

It must, however, not be overlooked that the decrease in negative slip was concurrent with a decrease in blade area as well, of which more anon.

It will be noticed that while the thrust of the 12·5 ft. screw in trial A is calculated at 5820 lbs., and the indicated thrust is more than double that figure, the ship's resistance by itself is only 3785 lbs. This means that the augmented resistance due to the big diameter screw was 2035 lbs., or an increase in resistance of nearly 35 per cent; whereas with the 9·0 ft. screw the augment was only 183 lbs., or 3·3 per cent.

Further, the frictional resistance of the screw in the first four trials is pretty much the same, due to the fact that with the decrease in surface there was an increase in revolutions; at the last, or E trial, the revolutions were increased very considerably, owing to the finer pitch, so that the I.H.P. was 420, but the propeller friction was thereby run up to 44·5 H.P., and the engine losses to 143 H.P. This is observable also when examining the relation of the hull resistance H.P. and the propeller H.P. with the indicated or gross H.P. developed by the engine. The efficiency of the machinery was greatest (0·572) at the A trial, when the revolutions were only 71; it was the worst with the fine pitched screw on trial E, being only 0·364. The general efficiency of engine and propeller was greatest on trial C, being 0·407, as against 0·387 of trial D, when the screw was most efficient; but the machinery, running then at 110 revolutions, was not so efficient as on trial C with 98·8 revolutions.

Before passing away from the *Archer* and her trials, one is left to conjecture by what process of reasoning a propeller 12·5 ft. in diameter, with 7·75 ft. pitch, was designed for engines to indicate only 199 horse power, and why this was done only four years after the *Rattler*, with her 10 ft. propeller and 11 ft. pitch, had obtained a speed of 10 knots with 428 I.H.P. and with 205 I.H.P. 8 knots per hour.

Experiments of a practical nature have been made since, but none of them have been free from objection, inasmuch as differences of diameter have been accompanied invariably with differences in pitch or surface, often both in pitch and surface.

Some interesting tests were made in 1878 on certain long voyage steamships, the results of which were given by Mr. Arthur J. Maginnis (*v.* Table XVIII) in his paper read at the Spring meeting of the Institution of Naval Architects in 1879, which tend to show that the screw of comparatively small diameter maintained at sea a better speed with a less consumption of fuel than did the larger ones.

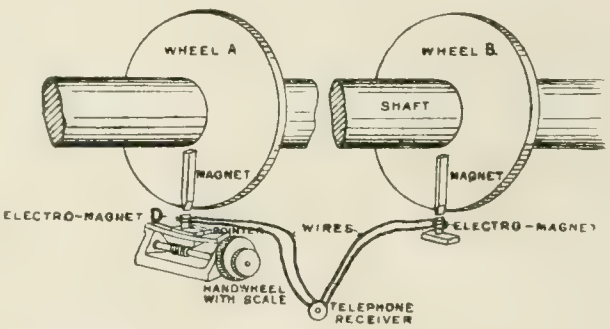
In the trials of H.M.S. *Iris*, which will be dealt with later on, the four-bladed screws of 16·25 diameter produced a speed of 18·57 with 7714 I.H.P., whereas the original four-bladed screw of 18·6 ft. diameter with 7503 I.H.P. produced only 16·58 knots. It is, however, only fair to state that the two-bladed Griffiths Screws of 18·1 ft. diameter gave as good a speed as the former with less I.H.P.

TORSIOMETERS AS APPLIED TO THE MEASUREMENT OF POWER IN TURBINES AND RECIPROCATING ENGINES.*

BY ARCHIBALD DENNY, ESQ., Member of Council.

WHEN the suitability of the turbine method of propulsion for commercial work was proved by the success of the *King Edward*, built by my firm in 1901, it became apparent to us that it would be highly desirable to have a method of ascertaining the horse-power transmitted by the turbine shafts to the propellers. Until that problem was solved we could only work from the boiler to the propeller, and the efficiency of the turbine and the propeller must be

Fig. 1.



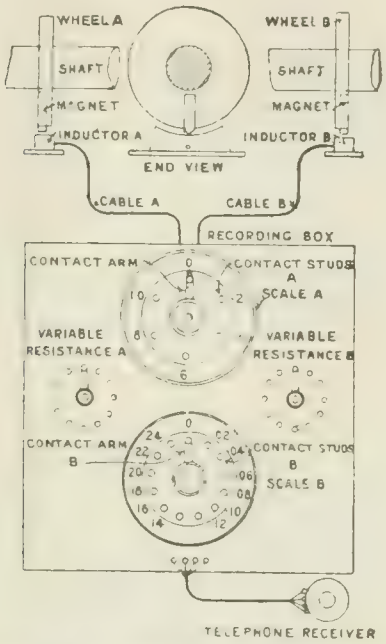
lumped together. It is not possible to "indicate" the turbine in the same way as is done for a piston engine, although I may say that a fair approximation can be got by ascertaining the fall of pressure through successive expansions by means of pressure gauges fixed to the turbine casing.

Some fifteen years ago we had made numerous experiments with factory shafting, endeavouring to ascertain the absolute torsion of a shaft while running, and it therefore immediately occurred to me that this was the proper direction in which to attack the problem. We had tried various methods, principally using pierced discs and beams of light, but with very partial success. We had not tried any method involving the use of electricity, and I therefore arranged for experiments to be made by this method, on one of our factory shafts. The first trials were made by fixing discs on the shaft at a considerable distance apart, so as to get a reasonable amount of torque. The discs were of insulating material, and each had a contact point arranged at its periphery in such a manner that the point made momentary contact with a metal tongue or brush once in every revolution of the shaft. The contact points were connected to the shaft and the metal brushes to a battery and a telephone receiver. The method adopted was to first adjust the brushes, so that both made contact with the points simultaneously when the shaft was

* Read at the Spring Meetings of the Forty-eighth Session of the Institution of Naval Architects, March 21st, 1907.

revolving, but transmitting no power. When transmitting power the shaft was, of course, subject to a certain amount of torsion, and thus the brushes were put out of simultaneous

Fig. 2.



contact. One of the brushes was then moved round its shaft concentrically, until simultaneous contact was once more established. The amount of this shift gave a measure of the torque on the shaft, and to ascertain the correct amount of this shift the telephone receiver was placed to the ear, no sound being heard except when both brushes were in contact with the respective contact points, when a loud "tick" was heard. The principle was thus of extreme simplicity, and the method of carrying it out seemed at first equally simple; indeed, I may say that this first rough apparatus, which was quite successful, only cost a few shillings to make. We then set about making more accurate and elaborate apparatus on the same lines to be fitted to the *Queen Alexandra*, which was nearly ready for trial, with an assured hope of getting satisfactory results.

The factory shaft on which we made the original experiments ran about 120 revolutions per minute, but the revolutions of the *Queen Alexandra's* side shafts were over 700, and when we came to make experiments at this high speed we found the new apparatus was useless, as no certain sound could be got. We tried many forms of contacts, and after numerous experiments we did succeed in the *Queen Alexandra*, with revolutions about 750, in getting some fairly consistent results, but it was impossible to be quite certain of the exact point at which the make and break in the circuit took place, and we were never quite sure of our results; still, we had made a great step in advance.

Mr. Charles Johnson, a member of our staff, who assisted in working out this problem and was closely connected with it from the first, thoroughly appreciated the difficulties, and realized the desirability of getting away from the unreliable rubbing contact, and he ultimately succeeded in solving the problem in a most ingenious way.

Fig. 1 and Fig. 8 show his original solution. Two gun-metal wheels, A and B, were fastened to the shaft at a definite and known distance apart, the distance being as great as possible. On each wheel a permanent magnet, with a sharp chisel-shaped edge, was fixed radially at the periphery of the wheel and with the sharp edge parallel to the shaft. At one end a soft iron electro-magnet C, wound with fine wire, similarly chisel-shaped, was fixed, so that the moving magnet passed directly over the electro-magnet once in each revolution. At the other end a similar electro-magnet D was mounted on a screwed sector, and wires from these electro-magnets were led to a differentially wound telephone receiver.

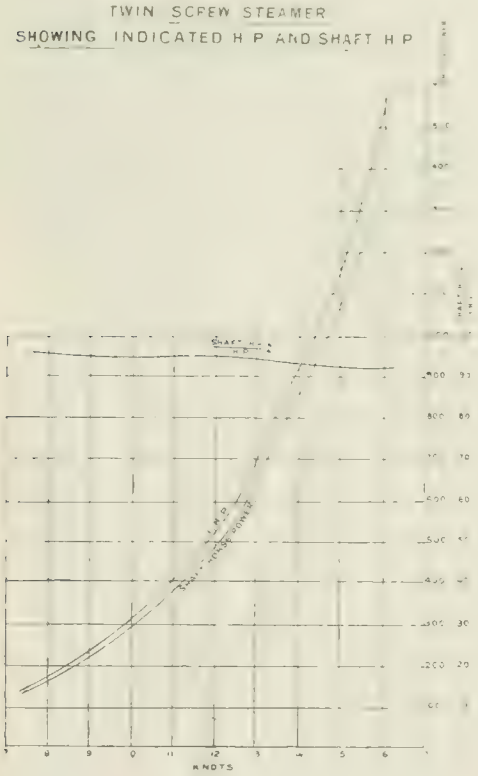


Fig. 3.

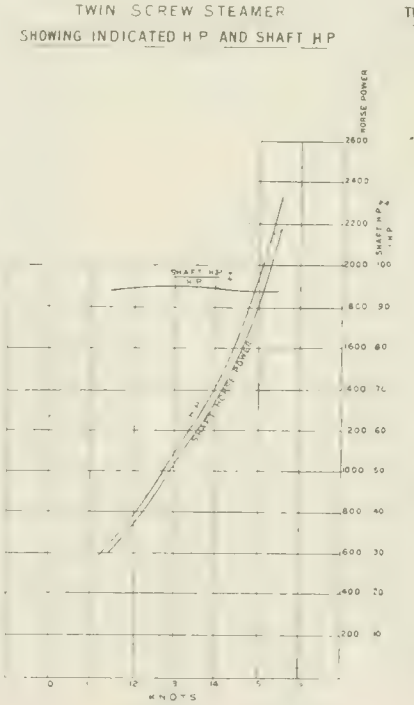


Fig. 4.

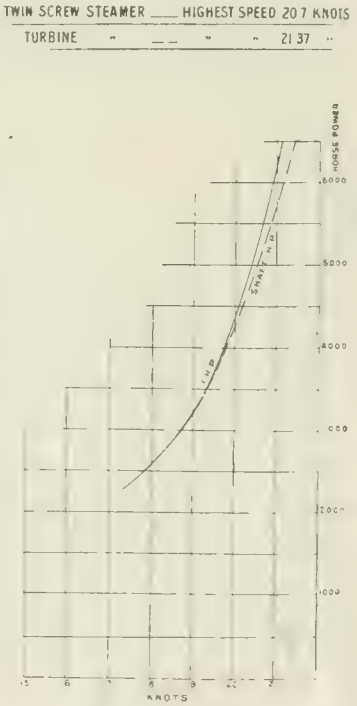


Fig. 5.

If the shaft revolved without transmitting power, the permanent magnets passed these electro-magnets simultaneously, and currents of electricity generated in each coil passed through the telephone receiver, but the currents being equal and opposite, no sound was heard. When the shaft transmitted power, the permanent magnets passed the electro-magnets at different times, and hence a sound was heard in the receiver. By turning the hand wheel shown in diagram a new position of silence could be obtained, when it was evident that the two permanent magnets were again passing the electro-magnets simultaneously, and the amount of torque could be ascertained from the reading of the sector screw.

This instrument was used on a number of the turbine vessels built by my firm with great success, but it required the operator to work in the tunnel, where even with turbines there is some noise and disturbance, and to overcome this objection, Mr. Johnson designed another arrangement, which is illustrated in Fig. 2. The gun-metal wheels and permanent magnets remain as before, but in place of the chisel-shaped electro-magnets, soft iron sector cores, marked inductors A and B, take their place. These cores are wound with a series of coils of very thin wire, so fine, indeed, that each coil, with its dividing wall in one of the sectors, only occupies a space of ·02″. This sector, or inductor as we term it, is fitted underneath one of the gun-metal wheels, and a similar one

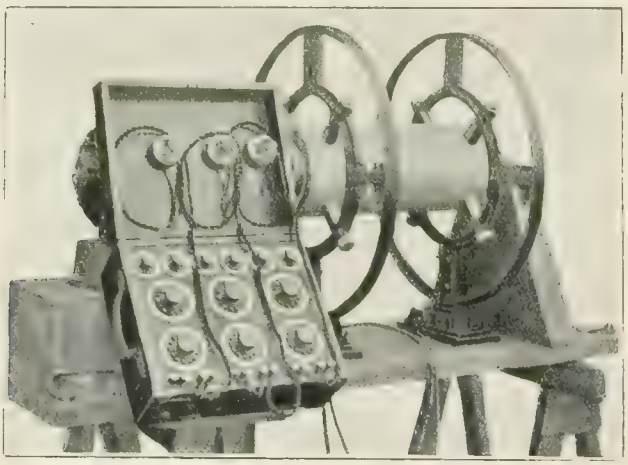


Fig. 6.

is fitted at the other wheel, but in this case the coils are further apart, namely, ·2″; the reason for this will be afterwards explained.

In Fig. 2 is also shown the recording box, which will be seen to consist of two circles fitted with contact studs and movable contact arms; the upper one, marked scale A, is connected with the inductor at the wheel next the propeller, and has six contacts; that is to say, there are six coils, spaced ·2″ apart. The other one, scale B, has 13 contact studs, which are similarly connected to 13 coils on the inductor at the turbine end of the shaft; these coils are spaced ·02″ apart. On the recording box will be seen two side coils, marked respectively resistance A and resistance B. These are resistance coils for throwing into series with the differential windings of the telephone receiver, which is connected to the two inductor circuits, which circuits must be accurately balanced before absolute silence can be got in the receiver.

Fig. 2 shows the arrangement of the apparatus for one shaft. With this arrangement it is possible to locate the observer in any part of the ship, cables being led from the inductors in the tunnel to the recording box, and we usually select some quiet cabin where the observer will be undisturbed. The sound in the receiver at usual revolutions is so distinct that even an untrained observer, after a very few minutes' practice, can get perfectly accurate results, and powers transmitted can be ascertained from moment to moment.

It is essential, of course, that the correct zero position, from which to start, should be found. In order to do this, zero lines, or rather grooves, are cut into the cover plate of the inductors A and B, directly over the zero coils, and in setting up the instrument the chisel-shaped magnets are brought directly over these lines, by first dropping them exactly into the grooves, and then raising and fixing them to just clear the top of the inductors. But we do not depend upon this method alone, because any inaccuracy in setting up the inductors might bring in small errors. We therefore get an absolute zero by running each shaft light alternately; that is to say, before the commencement or after the completion of the trials, each shaft is alternately run light, the vessel being driven by the other two screws. It is true that by this means we do not eliminate the effect of friction in the turbine and shaft bearings, but this must be very small, as we find our original method of setting the zero, when carefully done, is always confirmed by this method of checking the same.

To take a reading after the instrument is once set, and the resistance of the two telephone circuits is adjusted by means of the variable resistances A and B, all that is necessary is to turn the movable arm on scale B round the various studs until there is silence in the telephone, when the amount of

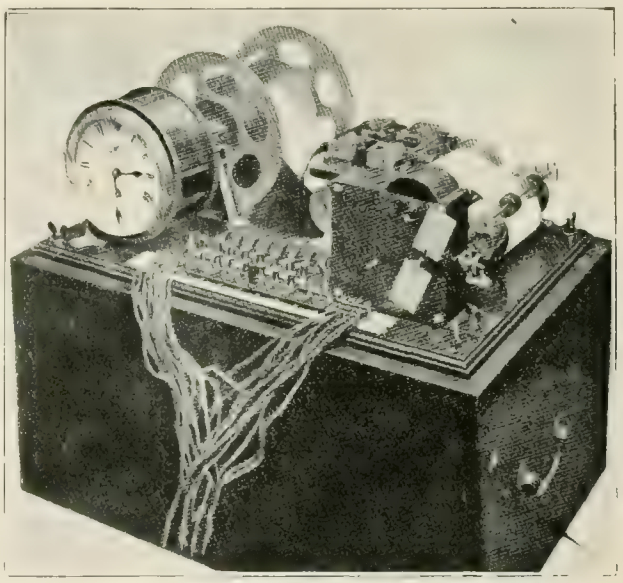


Fig. 7.

torsion is immediately read off the scale. If no such position be found, it means that the shaft in being twisted more than is covered by this scale; the arm A is then turned to the first contact, and the arm B is again swept round the circuits. If silence be still not obtained, the arm A is turned to the second contact, and so on, the combined range of the scales being altogether 1·24″, which is more than sufficient to measure the maximum torque usually obtained. From torsion experiments on the shaft, described below, made previous to its being fitted in the ship, or from a formula also given below, the factor by which this reading is to be multiplied is obtained, and the power is got by a simple multiplication sum.

This instrument is made for one, two, three and four shafts: for each shaft a group of circles as shown is required. By means of the contact arms and studs the various shafts are thrown into circuit with their receivers, and readings are taken from three or four shafts in a very short time. This instrument is not suitable for very low revolutions, as the induced current becomes too weak to make a distinct sound in the telephone, but it is suitable down to about 100 revolutions per minute. For lower revolutions the instrument first described is employed, but the operator must then be in the tunnel.

The testing of the shaft to get the torsion scale previous to its being fitted on board, is done by fixing rigidly one end of the length of the shaft to be used for the trials, and at the other end fitting a lever; this is loaded with weights so as to get the scale of torsion moment. For turbine shafts, which are small in diameter as a rule, this is not a serious

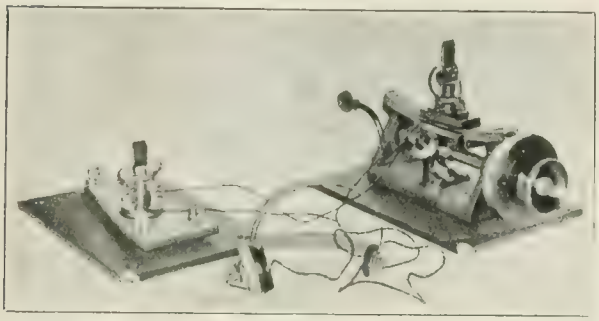


Fig. 8.

operation, nor, indeed, have we found it so even for larger ordinary twin-screw shafts, although of course the weights used have to be much greater. We have tested all the shafts for the turbines and other vessels on which we have used these instruments, and we find that the torsion is given very closely by the following formula:—

$$O° = \frac{W R L}{K d^4}$$

Where—

$O°$	=	Angle of torsion in degrees.
$W R$	=	Foot pounds turning moment.
L	=	Length of shaft in feet.
d	=	Diameter of shaft in inches.
K	=	Co-efficient.

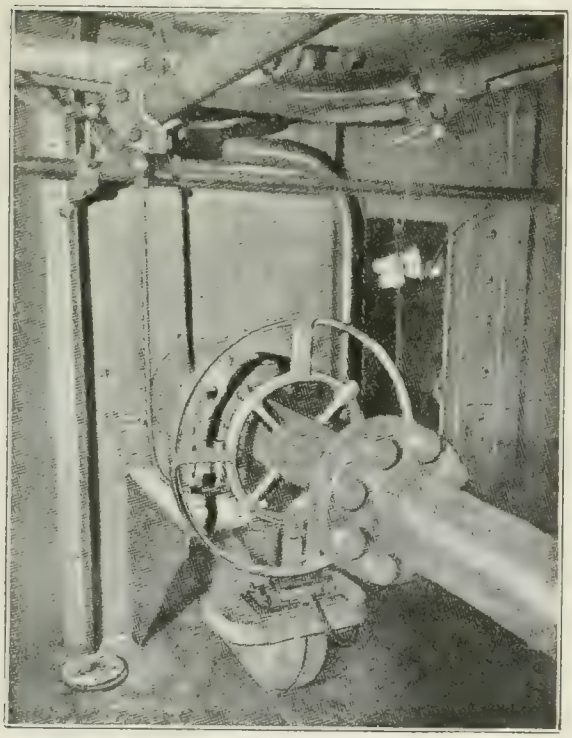


Fig. 9.

K may be taken at 140 for mild steel shafts where there are no couplings, or, if there be any, by deducting their length from the length of shaft twisted; that is, we assume that the couplings do not twist. It is, of course, better to test each shaft independently, but the error would not be great by using the formula, probably not 1 per cent. either way.

While this instrument was designed primarily for turbine engines, it was quite natural that we should attempt to use it for ordinary piston engines as well. In that case, however, on account of the variable torque throughout a single revolution, not less than six magnets ought to be fitted round the gun-metal wheel, and six sets of inductor sectors. This has actually been done in the case of two small twin-screw vessels with success, but it was a very cumbersome arrangement. The diagrams in Figs. 3 and 4 give the results of the experiments, from which it will be seen that they are very consistent, and show about 94 per cent efficiency for the steam engine.

Fig. 6 shows a set of recording instruments for three shafts, and the wheels and sectors for one shaft fitted to a dummy; the actual instruments are exhibited on the table. Fig. 9 shows one of the wheels as actually fitted in a tunnel.

As a still further convenience, we use on all our trials of turbine vessels, another machine shown in Fig. 7, with a roll of paper on which a time pen works, and also pens recording the revolutions of the turbines, and for convenience, these are only recorded for every tenth revolution of the turbine. This machine is also connected by electric cables with the bridge, by means of which the beginning and the end of the mile can be signalled, and thus we are able at one recording station, to ascertain the mean speed, the mean revolutions, and the mean power all taken by one or two observers in a quiet and undisturbed cabin.

The diagram in Fig. 5 shows the results got from two practically sister vessels, one fitted with twin screws, and the other with turbines.

The great advantage of these instruments is that we separate and define the efficiency of the turbine and the screw, and by this means we have been able to discover which is the best combination for any particular ship.

I feel we owe a great deal to the skill and perseverance of Mr. Charles Johnson, a son of the late Mr. Charles Johnson, a member of this society, who was with us for many years, and latterly in partnership with the late Mr. Wm. John.

Messrs. Samuel White & Co., Ltd.—A new pamphlet on marine water boilers has recently been issued by Messrs. Samuel White & Co., Ltd., of East Cowes, Isle of Wight. This firm have been, since 1885, makers and users of water tube boilers, principally in connection with high-speed vessels in which the working conditions were severe. The result of their practical experience has been the evolution of the "White-Forster" patent boiler in order to meet such conditions fully and economically, and at the same time embody the feature essential to efficiency and long life, *viz.*:—Simplicity in design and construction; facility for inspection, cleaning and repair; ample steam space in proportion to the heating surface; and the constructive details based on established boilermakers' practice

The question of removal and renewal of any, or all of the tubes, is an important one, and the following illustrate some of the points that have to be borne in mind:—1st: During manufacture a tube in the middle of a nest may fail at the last stage of expansion by tube expander. 2nd: A tube may fail under water pressure test of completed boiler. 3rd: On inspection of boilers by receiving officers after trial, they may discover some point in connection with any one tube, and wish it removed. 4th: On periodical inspections of condition of boilers, a sample tube from each row will reveal the actual condition. 5th: If service has been severe, the rows of tubes next the fire might require renewal before other tubes. 6th: The effects produced by a burst tube. 7th: The complete renewal owing to fair wear and tear. It is with these various matters in view that the "White-Forster" boiler has been designed to enable them to be carried out without any more difficulty being experienced than is met in a fire tube boiler, and all the necessary repairs to be made by the ship's staff. The catalogue is fully and effectively illustrated, and contains some valuable information as to various details in the working of the boiler.

The Photograph given in our supplement, last issue, was by Lafayette, Limited, London.

"LITTLE-HUSTLER" AUXILIARY MACHINE TOOLS.

IT is now some two years ago that the "Little-Hustler" variable speed drills were introduced on the market, and although prejudice exists against electrically operated tools on the question of reliability, this appears to have been overcome as far as this tool is concerned, having regard to the wide use to which it has attained. The machines are built for either direct two-phase or three-phase current. Fig. 1 shows a breast drill which is adaptable to three speeds by gearing, and not by putting in electrical resistance, which is most wasteful. The drilling mechanism is driven by a shunt-wound motor, and the whole device is extremely light; for example, a machine capable of drilling a $\frac{5}{8}$-hole and having speeds of 420, 630 or 840 revolutions per minute weighs only 24 lbs.

The boring pressure is taken on ball bearings, and the gear is arranged so that steel works on bronze, while for the purpose of reducing weight all non-magnetic parts are made of a special aluminium alloy. The brushes of the motor are of the carbon self-adjusting type, and the switch which controls the working is fixed in a convenient position, so as to make it unnecessary for the operator to relax his hold of the tool in starting and stopping.

PATENT.

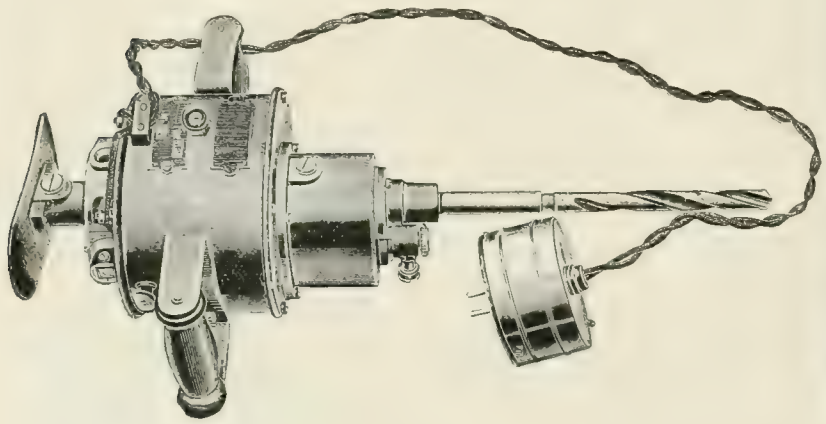


Fig. 1.

Perhaps the most important advantageous feature of the machine is the automatic overload cut-out by which it is protected. This device is contained in the adapter top, which connects the tool to the current supply. Being adjusted to a given maximum current, it automatically stops the motor when an excessive overload is applied, automatically restarting the tool when the bore pressure is reduced to normal. It will be recognised that this device presents a feature of great value to any tool liable to heavy overload, as in the past burning out has frequently resulted when they are not so protected.

Fig. 2 represents the tool adapted as an angle-post drill for use where the larger types are concerned, as owing to their weight they are hardly suitable for continuous breastwork. The drills are fitted with an adjustable collar and screw hand-feed.

The tools are manufactured by the Armorduct Manufacturing Company, Ltd., of Farringdon Avenue, London, E.C.; 17, Eldon Square, Newcastle-on-Tyne; and Conduit Works, Warrington.

PATENT.

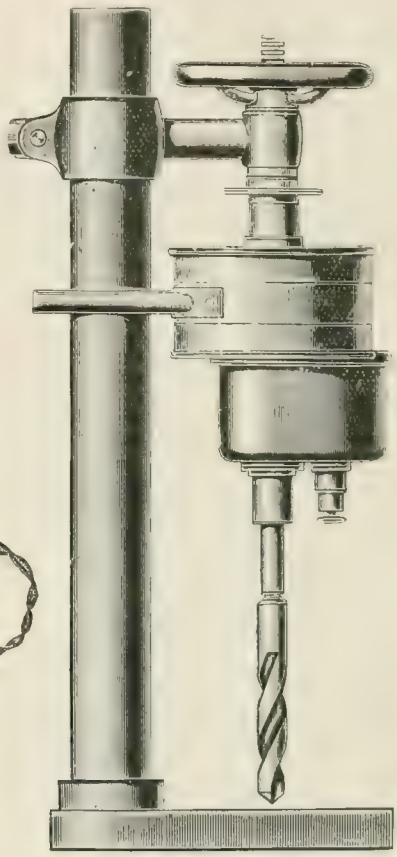


Fig. 2.

Heimdal.—On May 25th Messrs. S. P Austin & Son, Limited, launched from their shipbuilding and repairing establishment at the Wear Dockyard, Sunderland, the steel screw steamer *Heimdal*, which has been built to the order of Messrs. The Angfartygs-Aktiebolaget Göteborg-Manchester, of Gothenburg. She is designed to carry about 1650 tons deadweight on light draught, will be classed 100 A1 in Lloyd's Register under special survey, and is intended to trade between Gothenburg and Manchester, carrying pulp and general cargoes. Accommodation for captain is provided in a house on the bridge deck, engineers and officers in after part of bridge, and the crew are placed aft in a short full poop, the topgallant forecastle, which is of extra length, being left open. The machinery will be supplied by the North-Eastern Marine Engineering Co., Limited, and the deck machinery, including steam windlass and steam winches by Clarke, Chapman & Co., Ltd., steam steering gear by Donkin & Co. will be supplied with steam from a large multitubular donkey boiler made by the Blake Boiler Company, Darlington. The constrnction has been carried out under the superintendence of Mr. H. J. H. Wilson, of Messrs. A. Schaeffer & Co., Newcastle-on-Tyne, on behalf of the owners, and the vessel was named by Miss Peggy Dugdale, daughter of the managing director of the builders' company

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Deaths.

THE Cunard Line has sustained another severe blow in the death, at the comparatively early age of fifty-nine, of their able and popular general manager, Mr. A. P. Moorhouse. In these days of keen competition and of pools and conferences the paths of general managers do not always lie in smooth places, and those of Mr. Moorhouse, when the Cunard Company stood alone to face the competition of the German Lines and of their ally the Combine, must have been particularly rough and anxious. But the premier British Company held its own in the contest thanks in large measure to the tact of the then chairman and to the ability of the manager. How severely the strain must have told on those who stood in the forefront of the battle was hardly realized at the time by the onlookers. But we now begin to appreciate what a contest it must have been. For Mr. Moorhouse has not long survived his chief. Whilst those of us who had the honour of knowing him lament a genial friend and a most capable administrator, it is a satisfaction to realize that the vacant space in the ranks is already filled up and that Mr. Mearns, who has so long been secretary of the Company, and has recently been acting as assistant general manager, will be in a position to take over the reins and to look after the interests which have been entrusted to his care.

Engineering journalism is much the poorer by the death of Mr. G. R. Dunell, who made his mark as a writer in the columns of the *Times* and of our contemporary *Engineering*. Mr. Dunell died somewhat suddenly and unexpectedly on the 12th May in St. Thomas's Home, where he had recently, and apparently successfully, undergone an operation for an internal complaint. Not only was he a most competent authority on the subjects with which he dealt, but he was a man of strong personality who endeared himself to all those who had the pleasure of being thrown in contact with him.

Disasters.

It will be remembered that three steamships stranded within a few hours of one another on the night of the 17th March in or near the entrance to the English Channel. They were the steamship *Newstead*, since floated, the Elder-Dempster liner *Jebba*, which went entirely to pieces after some salvage of cargo had been made, and the White Star liner *Suevic*, whose main body was salved at the expense of her bow portion. By order of the Board of Trade inquiries have now been held into the circumstances attending each of these casualties, and in each case there has been a finding of default on the part of the navigator. Speaking of the *Suevic* and *Jebba* cases together, it should be noted that in each case the ship overran her distance, and so found herself upon the rocks. It would appear that the weather was such that in the approach to the Channel those in charge of these vessels were not in a position to obtain any assistance from observations. They thus seemed to have relied almost entirely on dead reckoning, that is to say, on the record of the patent log. Now, useful as the patent log may be, it cannot be too strongly insisted upon that its powers as a guide have decided limitations. One has, in the first place, to remember that in nearly all cases these instruments have their percentage of error. This, indeed, is generally known and allowed for by those who use each particular instrument. But there is a much more serious weakness, and one which is so inherent in the nature of the appliance that it can never be guarded against. That is the fact that the patent log is exposed to the same influences of tide and current as is the ship herself. This being so, it should never be forgotten that the patent log can only assist the mariner to estimate what his ship is doing *through the water*—it cannot aid him to arrive at any conclusion as to what she is doing over the ground. When these two liners, the *Suevic* and the *Jebba*, struck the rocks, it became apparent to those in charge of them, as I have already stated, that they had overrun their distance, and it followed that the ships must have been subjected to some easterly set, of whose existence till then their officers had been unaware. No doubt when these gentlemen had access to the records of the Meteorological Offices they learnt that there had been westerly gales prevailing in the Atlantic and that thus the existence of the set to which their ships had fallen victims was fully explained. But westerly gales are by no means unusual, and such sets as have been referred to are a danger to which mariners must expect to be subjected. It would be indeed a serious matter, as well for those who go down to the sea in ships, as for shipowners and underwriters, if the influence of such a set was a thing against which nautical skill is of no avail. But there is no need to take any such despairing view. The mariner has another guide as to his position, and one which does not in any way work by dead reckoning. He has the lead and should always check his position by its use. No doubt the lead was used by those in charge of both these vessels. But it cannot be too strongly insisted upon that single casts are not enough when making the land. A whole chain of soundings must be taken to make certain the position of the ship, and it was for failure to do this that the two experienced and capable mariners in charge of these two steamships suffered suspension of their certificates. There are, of course, places where soundings are so similar over considerable areas that even the lead cannot aid the navigator to identify his position with certainty. In such cases he can only wait till he can make sure of his whereabouts by some other means. But the entrance to the English Channel is not one of these. The story told by a series of careful soundings is here quite reliable, and that being so one cannot be surprised at the course taken by the two Courts of Inquiry.

No doubt the circumstances attending the loss of the tank steamer *Silverlip* of the Shell Transport and Trading Company, will be thoroughly investigated by a Court of Inquiry. But at present the story seems as mysterious as it is disquieting. The vessel in question was not only one of the largest, but also one of the latest and most perfectly designed of oil-carrying steamers. Her machinery and boilers were right aft, separated from the cargo tanks by a double hedge of water-filled spaces and bulkheads. Her galley was also aft and there appears to be no room for the suggestion that the electric lighting installation was in any way accountable for what occurred. For the casualty took place at two o'clock in the afternoon and the electric current was switched off, except in the engine- and boiler-rooms. Whatever may have been the cause, the disaster was both sudden and alarming. A violent explosion occurred in No. 4 tank and immediately flames shot some seventy feet into the air. The master was not on the bridge at the moment, but he managed to rush forward through the flames and take charge of the ship. Then immediately the flames formed an impassable barrier, effectually preventing any communication between those at the two ends of the vessel. Explosion followed explosion, and in a short time—it having been seen from the first that the ship was doomed—it was necessary to take to the boats. These were put into the water by those at the after end of the *Silverlip*, and some of those at the fore end were saved by jumping into the water to be picked up by the boats. Five lives, however, were lost, whilst about half a dozen men were badly burnt. The loss of the *Silverlip* will be memorable in the annals of the profession of marine engineers from a deed of devotion, for Mr. Bell, the chief engineer, fell a victim to his heroism. After the first explosion he went forward to call the pump man, and was not seen again. The pump man, for whom he laid down his life was amongst the saved, but he suffered severe injuries. The loss of life would undoubtedly have been far greater had not the steamship *Westgate* been in the neighbourhood and hastened to assist. She picked up the boats with their forty-eight survivors, whom she landed on the 3rd May at Plymouth, where several were found to be so injured as to necessitate their being taken to the hospital.

It is suggested—though as yet no evidence in support of the theory has been made public—that the explosion was due to secret smoking by some member of the crew. If this be so, it would seem that no precautions can prevent the recurrence of such accidents. When disasters are due to failure of material the wit of man can generally see some way of meeting the difficulty. But in case of failure of the human element there is an insuperable obstacle to be overcome. It may be, too, that difficulties will be again thrown in the way of the transport of such cargoes through the Suez Canal, for it is said that the *Silverlip* was the first tank

steamer to bring benzine through the Canal under the new modified regulations. One cannot fail to shudder when one tries to imagine what would have occurred if the explosion had taken place in that waterway—possibly in the vicinity of a crowded passenger steamer—and some nine thousand tons of oil set on fire in those narrow waters.

The "Adriatic."

I had the good fortune to have the opportunity of visiting the new White Star Liner *Adriatic* on the day preceding her departure from Liverpool. She indeed expresses the last word in comfort and luxury at sea. Space—a thing necessarily economised in shipbuilding—has been placed with lavish hands at the disposal of her passengers. Take the bath accommodation, for example. Not only are the usual bath-rooms distributed about the ship as plentifully as has been the custom in recent steamships of the first class, but a whole bathing establishment has been introduced. That expensive luxury, the electric light bath, has been placed at the disposal of the first-class passengers, as well as a spacious Turkish bath, whose equipment includes a plunge bath of no inconsiderable size. Roominess characterizes all the public room —the smoke-room, which is exceptionally lofty, and the writing-room whose satin-wood furniture seems too exquisite for use by ordinary folk. This latter room has windows of a size never before seen on shipboard. They complete the illusion that one is in a palace instead of at sea. Yet at the same time the arrangement is so cunningly devised that there is no chance of the Atlantic, in one of its angry moods, breaking in and showing its mastery over the ship-builder and designer. The lounge, too, is most attractive, and, from the opportunity it affords for conversation under comfortable conditions, it is sure to be popular, especially in cold weather. But it is in the saloon that the disregard of space is most noticeable. The whole room is filled with small tables—the largest apparently not seating more than a dozen guests. By this means parties of friends are afforded a privacy otherwise unattainable. But at what a cost to the Company! Looking round the room and figuring out what it meant, one was driven to the conclusion that under the old system of long tables, placed so as to make the most of the floor space instead of the least, probably double the number of persons could have been seated in the room.

A word must be said as to the scheme of lighting and ventilation in this dining-room. Thorough ventilation is afforded, whilst the possibility of draughts has been carefully guarded against. Light is provided, not only by shaded lamps on the table, but by cut-glass pannels in the ceiling as well as by the ordinary ceiling lights. Then there is the installation of electric lifts for passengers and for mails, and above all the spaciousness of the state-rooms where the landsman, from the time of Dickens onwards, has found that he is apt to be too confined for his comfort. Amongst other appliances for safety, there is, of course, a Marconi installation of wireless telegraphy and a system of receivers for taking up the signals of submarine bells. Whilst so much care has been displayed on the luxury of the first-class passengers the comfort and convenience of the second and third classes of travellers have by no means been neglected, and second-class aboard the *Adriatic* should be good enough for most people. I think the new ship—which won for herself golden opinions on her maiden voyage to New York —will somewhat astonish the good people of Southampton when she makes her first appearance in the port which is to be her future home.

Turbine Steamships.

The need for a Channel Tunnel for the sea-sick passenger is surely no longer arguable. Three-quarters of an hour's discomfort cannot hurt even the most weakly and timid. Three-quarters of an hour is now the record for a channel passage—thanks to Mr. Parsons' invention. On Saturday, the 13th May, the *Victoria*, first of the pair of sisters which the South-Eastern and Chatham Railway is placing on their route, made her record, doing the passage in no more than forty-six minutes. She thus beat the best previous performance, that of the *Invicta*, by some four minutes. This does not, perhaps, sound a great deal. But it is a reduction of some eight per cent., and would be considered a great deal if it were achieved on so long a voyage as, say, the Atlantic crossing.

Meanwhile a new adherent to the turbine system has been found in the London and North-Western Railway, who have placed an order for a turbine-engined steamer of twenty-three knots speed for the Holyhead and Dublin route. Messrs. Vickers, Sons & Maxim have the building of this ship, as well, I believe, as of two other vessels of similar character, but fitted with reciprocating engines, for the same service. It would seem, therefore, that the North-Western Company will have every opportunity of arriving at decided conclusions as to the merits of the rival systems.

Messrs. Vickers, Sons & Maxim have also received an order for a twenty-four-knot turbine vessel from the Isle of Man Steam Packet Company, who thus give a practical demonstration of their faith in the new invention, by ordering a repeat of their successful vessel, the *Viking*.

Further, the Belgian State Railways have ordered a sister to their *Princesse Elizabethe* from the same builders who constructed her for them—the John Cockerill Company, of Hoboken. They have found from the working of the steamship already in service that there is an economy in coal consumption of the turbine engined ship over the old-fashioned paddlers, on which they relied till two years ago, of no less than twenty-five per cent., whilst, if the same quantity of fuel be allowed, there is an increase in speed of some fifteen per cent. The actual figures work out at twenty-three tons consumption for the passage between Dover and Ostend, the voyage occupying some three hours and seven minutes as the average of a long series of passages. This is twenty-eight minutes better than the average of the best of the paddlers, and the result is reached with a slightly lower consumption than theirs.

Other Orders

have been placed by the Dominion and Pacific Steam Navigation Companies. The first-named line has ordered the *Alberta*, a sister to the 14,000 ton *Albany*, whose commencement by Messrs. Harland & Wolff was announced earlier in the year. Both these Queen's Island vessels are to have reciprocating engines. They are, of course, for the Canadian branch of the Company's service. In mentioning this line I may take the opportunity to answer a correspondent's query as to the old *Ottawa*. She is again at work after her winter's rest, having taken up the sailings between Liverpool and the St. Lawrence.

The Pacific Steam Navigation new ship has been ordered of Messrs. Beardmore's. She is to be a passenger vessel of over 11,000 tons and to have twin screws.

An Old Liner.

A famous liner is passing into the shipbreakers' hands. This is the *Terek*, which acted as one of the auxiliary cruisers of the Russians during the recent war, and in their hands earned a somewhat unenviable notoriety as from her interference with neutral shipping. My readers will know her best as the twin-screw liner *Columbia* of the Hamburg, Southampton and New York express service of the Hamburg American line. She was built for that service at Birkenhead by Messrs. Laird's in the year 1889, and, if my memory serves me right, first left the passenger trade to serve the Spaniards during their struggle with the United States After the conclusion of that war she came back to the Atlantic till the outbreak of hostilities between Russia and Japan appeared inevitable. She has now been purchased by Messrs. Ward & Co., of Sheffield, who propose to dismantle her at Barry, and then tow her to Preston for final demolition. Like the *Normannia*, built at the same date for the same service by the Fairfield Company, her career has been a brief one in comparison with that of many of the older iron vessels.

The New Australian Mail Contract.

From time to time I have mentioned the difficulties which have befallen the syndicate which has assumed the new contract for the Australian mails. That contract was accepted by the Australian Mail Liners Syndicate, Limited, whose constituents included the powerful shipbuilding firms of Messrs. Armstrong, Messrs. Beardmore and Sir Jas. Laing, with a shipowning company to look after the management. Various difficulties have cropped up in the path of the contractors and certain of the firms named have retired from the syndicate. In the middle of the present

month it was announced that notice has been served by the Commonwealth Government that the contractors' bond must be increased by some £25,000 in consequence of their failure to commence within the agreed time the construction of the new steamships which are to maintain the intended service. These steamers were to be some eight in number and to be of considerably greater size and larger power than any as yet engaged in the Australian mail service under the British flag.

been applied already to several well-known vessels, and is seen to do away with shafting entirely and substitute for this detail a flexible cable with all the advantages the latter posesses of freedom from breakdowns and handiness. The general arrangement, Figure 1, shows the engine placed in the stern and control station at the bridge with the cable between them. Figure 2 shows this more in detail, and Figure 3, the controlling

Fig 1

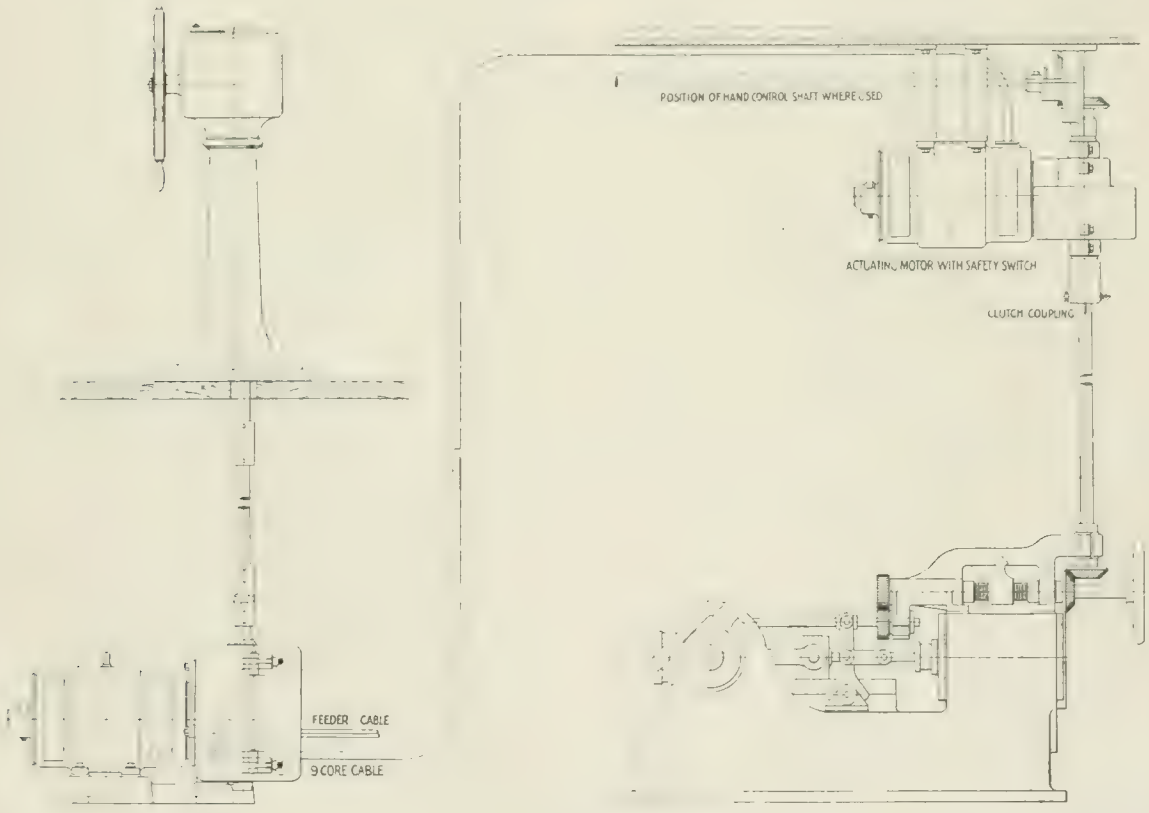


Fig. 2.

ELECTRICAL CONTROL FOR STEERING GEAR.

WE are enabled to illustrate an interesting application of a Combined Electric Control with the ordinary Steam Steering Engine, which should have a good future before it. The system has

motor shunting switch by which the motion of one motor is made synchronous with the other, the steering gear is connected directly to the middle gear, and in addition there is the Electric Control we are describing, which is connected, not only to the armature of the main electric motor, but also to the valve of the engine. We need not stop to discuss

steam steering gear, the feature being the Electrical Equipment. The steering hand-wheel on the bridge operates a vertical shaft which extends to a shunting switch and controlling motor, the location of these below the deck being intended to obviate any possibility of interference with the compass, a slight turn of the hand-wheel and therefore of the vertical spindle causes current to pass to the Controlling Motor, the working of which causes a disc geared to it to follow another connected to the vertical shaft, and as long as the steerman turns the hand-wheel the two revolve together, the one punting the other, and immediately the hand-wheel is stopped the current is cut off, stopping the action of the steering gear. The current is passed by the punting switch to the actuating motor, which again sets in motion the main motor through the connections. through the consequent motion of the switch, contact is made between the controlling station, the actuating station and the ship's generating station, and the apparatus begins to work. The motion continues until the upper bevel wheel occupies the same position with respect to the lower bevel wheel that it did originally. The switch will then be in its original position and the apparatus comes to rest. The actuating motor is geared to the steam valve of the engine, so that the motor opens the valve and the engine closes it the moment it overtakes the motor. It only remains to say, two safety switches are provided, one for use when the rudder head is in its extreme position either to port or starboard, while the other protects the apparatus in case the engine should break down or should fail to respond to the

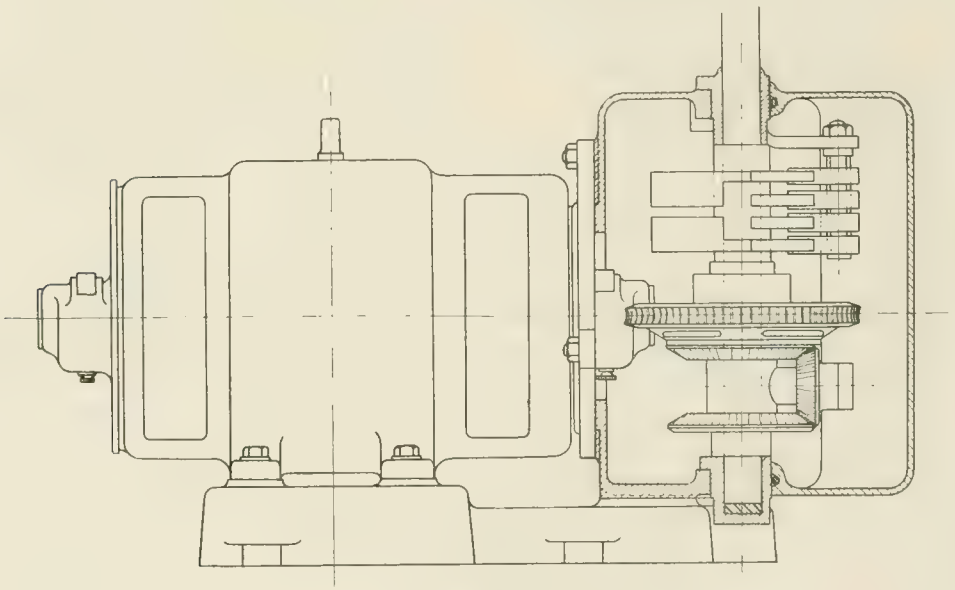


Fig 3

The contacts are so arranged that the current will go on gradually and the risk of sparking is reduced. The Controlling Motor re-acts on the punting switch by means of which the current to itself and to the actuating motor is controlled. Both motors work synchronously, so that they rotate through an arc exactly corresponding to the amount the steering wheel is turned. From our description, it will be seen that on turning the hand-wheel, the lower bevel wheel in Figure 3 is revolved on the differential punting switch, while the upper bevel wheel is operated by the motor through worm gearing, and the smaller bevel wheel is connected to, and operates the switch gear. The small bevel wheel therefore rotates when the steering wheel is turned, and actuating motor from any cause whatever. The makers of this very ingenious system are Messrs. Siemen Bros., & Co. Ltd., of Westminster.

The Institution of Mechanical Engineers held a conversazione at their premises at Storey's Gate, Westminster, on May 15th.. There was a large gathering of members and friends, who were received and welcomed on entering the large hall by the president, T. Harry Riches, Esq. The band of the Scots Guards played selections during the evening at intervals in the large hall and in the library. The visitors were also entertained by a violinist and by singers, who added to the pleasure of the evening. Prof. Hele Shaw gave a lecturette on the flying machine, illustrated by lantern and cinematograph, and this was highly appreciated by the audience, the lecturer was at once interesting and entertaining.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondents.*)

Portsmouth Dockyard.

THE month of May has been a memorable one for Portsmouth. On the 3rd, the review in honour of the Colonial Premiers took place, and on the 24th, we were honoured by a visit from Prince Fushimi of Japan. The Prince of Wales also came here on his way to Osborne with his son, Prince Edward, who has joined the Royal Naval College as a cadet. Our Colonial cousins evinced the greatest interest in the *Dreadnought*, from the upper deck of which they witnessed an attack on that vessel by submarines and destroyers. A slight mishap occurred to one of the destroyers, the *Coquette* damaging her bows by colliding with a floating coal hulk. The visitors made a tour of the yard, and this enabled them to contrast the great battleship with earlier specimens of naval architecture. A visit to Whale Island followed, and here the guests witnessed an attack by a squadron of gunboats and the landing of a naval brigade. The attack was repulsed by the shore party, who brought into use an armoured train. Then the Gunnery School was inspected, after which the party was taken afloat to view the Home Fleet at Spithead. Altogether the arrangements were most perfect, but a drizzling rain somewhat interfered with the visitors' enjoyment. The *Dreadnought* returned on May 16th in order that new propellers may be fitted. London papers are busy with rumours as to the launching of the *Bellerophon*, and one journal has announced that the King has consented to perform the ceremony. Good progress has been made with the vessel, over 5,000 tons of material having been built into her, while the shaft brackets of her four propellers have been in for some weeks. Her tonnage will be 18,550, 650 more than the *Dreadnought*, and she is to be provided with 4-inch guns instead of 12-pounders for resisting attacks by torpedo boats. The *Euryalus*, flagship of Rear-Admiral Inglefield, of the Fourth Cruiser Squadron, arrived from the West Indies on May 12th and has been taken in hand to be fitted with the latest improvements in wireless telegraphy. The cruiser *Fox*, of the local division of the Home Fleet, has gone to Haulbowline to be refitted and prepared for foreign service, and will, I understand, have about £20,000 expended on her. The steam repair ship *Assistance* has joined the Channel Fleet after a refit, necessitated by her grounding at Tetuan some eighteen months ago. The battleship *Exmouth* has also completed her refit and rejoined the Atlantic Fleet as flagship of Vice-Admiral the Hon. Sir Assheton Curzon-Howe. The *Drake* was paid off at the beginning of the month and recommissioned as flagship of Rear-Admiral Adair, commanding the Second Cruiser Squadron. Her commission lasted three years and two months, during which time she steamed 44,000 miles and consumed 36,900 tons of coal. The vessel was honoured with an unusual number of Royal visits. The King inspected the ship and slept on board at Portsmouth for one night when she was commissioned. Other visitors were the Queen, the German Emperor, the King and Queen of Portugal, the King of Italy, the King and Queen of Spain, the King and Queen and Prince Andrew of Greece, Princess Royal, the Duke and Duchess of Connaught and Princess Henry of Battenberg. To commemorate the commission of the vessel as flagship of Prince Louis of Battenberg, the ship's company gave a grand paying-off ball and invited all the officers. It was expected that Prince Louis would have been in England, but his late flag captain, Captain Mark Kerr, was there. Some important changes in commands have taken place recently. Commodore Briggs has attained to flag rank and has left the torpedo school ship *Vernon*, his successor being Captain Gamble, who had command of the *Canopus*. Commodore Briggs was a very popular officer, and all his comrades of the *Vernon* feel that his promotion is well merited.

Chatham Dockyard.

The most noteworthy event since I wrote last has been the presentation at the end of April to the *Natal*, which had been subscribed for by the residents of the Colony, after which the cruiser is named. The gifts were presented by the Agent General, Sir William Arbuckle, who was accompanied by the Hon. F. R. Moor, the Prime Minister of Natal and several prominent colonists, who were in this country for the Colonial Conference. The presentation consisted of a silver centrepiece and candelabra for the officers' mess, a silver shooting trophy, a bronze ship's bell and one hundred pounds sterling, the latter to be devoted to prizes for shooting. The Agent-General, in handing the gifts to Captain Nicholson, said he was sure that no contribution from the Colonies to the Navy was made in a parochial spirit, and he thought it would be an unwise thing for Colonists to ask for a local distribution of the Navy in consideration of their contributions. Their motto should be "One Fleet, One Flag, One Throne." The *Natal* afterwards proceeded with the Home Fleet to Spithead for the review in honour of the Colonial Premiers, and took part in the cruise of that fleet. While the vessel was mooring at Spithead, Lieutenant Petre met with an accident and fractured his leg, necessitating his removal to Haslar Hospital. The special torpedo vessel *Vulcan*, which recently returned from the Mediterranean, arrived here on May 7th. She is to be fitted with the Dürr water tube boilers, which were removed from the obsolete cruiser *Medusa*. The torpedo gunboat *Hussar*, which has been attached to the Home Fleet at the Nore, was brought up to full complement on May 7th for service in the Mediterranean. Besides carrying out her ordinary duties, the vessel is to be available for the private use of the Commander-in-Chief, and for this purpose will be stored and fitted at Malta. Admiral Lord Charles Beresford, when in the Mediterranean, had for his use the despatch vessel *Surprise*, but when His Lordship took command of the Channel Fleet he had that vessel transferred. Another of the vessels of the Home Fleet, the cruiser *Scylla*, was brought up to full crew the same day as the *Hussar* for special service in the West Indies. This is, no doubt, a result of the recent troubles in St. Lucia. The *Leviathan* has completed her refit and rejoined the Fifth Cruiser Squadron. It is generally agreed that she was refitted in a most rapid and efficient manner and well within the time allowed. Her engines develop 30,000 I.H.P. and she has forty-three Belleville boilers. All the generating parts were removed, made good and replaced, in addition to the other machinery being overhauled. So altogether it was no light job and the engineering department and the dockyard staff are to be congratulated. The cruiser *Forte* is expected shortly from the Cape of Good Hope. She is to be paid off on June 6th and after being refitted will be recommissioned for the Home Fleet. A sale of old vessels took place on May 14th, and included the gunboats *Banterer*, *Firm*, *Watchful*, *Mistletoe* and *Grappler*, which formed part of the old boom defence across the Medway, the surveying vessel *Goldfinch*, and the barge *Pert*. They all sold for fairly good prices, the *Goldfinch* being the highest at £4,450, while the other gunboats ranged from £3,375 for the *Mistletoe* to £1,825 for the *Firm*. A well-known officer, Commodore Stopford, of the Naval Barracks, has retired. He was most unfortunate, for he had reached the top place on the captains' list and in a short time would have been promoted to rear-admiral, but the age rule is inexorable and he had to go. His successor is Captain Bradford, who was flag captain to Admiral Sir Arthur Wilson. The future of Chatham is still engaging attention. Mr. E. Robertson, the Parliamentary Secretary to the Admiralty, received at the House of Commons on May 7th in private a deputation on the subject. The speakers included Mr. Jenkins, M.P. and Mr. Lamb, M.P. and the mayors of Chatham, Rochester and Gillingham. Mr. Robertson said he fully recognised the right of the deputation to make the representations they did, and he would consider the points they had put before him. After consulting his colleagues at the Admiralty he would communicate with them on the subject.

Devonport Dockyard.

The *Temeraire* is making splendid progress and one can now realize what an immense vessel she will be. Material has been reaching the yard much quicker than was anticipated, and the facilities for handling material on the slip on which the vessel is being built are so perfect that by the time she is launched in August it is probable that a record weight will have been built into her. Secrecy is not now so strictly observed and the order prohibiting the public from visiting

the slip has been withdrawn. The usual practice of placing at the side of the slip a board giving the dimensions and other details has, however, not been carried out. The repairs to the battleship *Commonwealth* have now been completed and on May 28th she recommissions for the Channel Fleet. The *Mars*, which has temporarily taken her place has returned. Two other battleships of the Channel Fleet have arrived for refits—the *New Zealand* and *Vengeance*. Special attention is being given to the torpedo net defence and all nets of a doubtful nature are being replaced. The wireless and Whitehead equipment is to be brought up-to-date, the fire control instruments are to be moved to better protected positions and dynamo firing arrangements are to be fitted. The vessels are to be out of hand early in June. The battleship *Cæsar*, which has been acting as flagship of the Atlantic Fleet while the *Exmouth* has been under refit at Portsmouth, has returned and rejoined the Home Fleet. The fitting out of the old cruiser *Spartan* as a workshop in connection with the torpedo school ship *Defiance* is approaching completion. She will be moored next to the *Defiance* in the position now occupied by the *Cleopatra*, that vessel being moored next to the *Spartan*. It has been the custom for parties of cadets from the Royal Naval College at Dartmouth to visit the yard from time to time, but the lads have looked on the visits as holiday trips. Henceforth, they are to form part of the regular routine. Every Wednesday during the summer, a party will be brought round in a destroyer for the purpose of inspecting the various shops. The innovation should prove extremely useful to the cadets in their work. Our division of the Home Fleet went to Spithead to join Admiral Bridgeman's flag and to cruise with the combined fleet. The vessels returned about the middle of the month. While the fleet was at sea, a seaman of the cruiser *Cumberland* fell overboard, but a corporal of marines, notwithstanding that the vessel was going at a fairly good speed, jumped overboard and succeeded in holding the man up until assistance arrived. In July, Mr. R. H. Andrews, the manager of the engineering department, will reach the age limit and retire. It is understood that in appointing his successor the Admiralty will follow the precedent set at Portsmouth by selecting a naval engineer officer. I am told that that officer has already been selected and that the lucky individual is Engineer Captain W. L. Wishart, who is at present engaged as chief engineer at Malta Dockyard. This course, it is stated, will be followed at the other yards as vacancies occur. The innovation will be extremely popular with naval engineer officers, for the number of appointments open to engineer officers of high rank is not at all large.

Sheerness Dockyard.

Our captain superintendent, Rear-Admiral Startin, left us on May 4th and Captain Casement took up the reins of office. The retiring officer was very popular with all classes, and when he left the Dockyard station in the afternoon for London, several members of the Urban District Council and of the Schools Management Committee were on the platform to bid him farewell, in addition to a large number of officers of both services. The week before he left, a deputation of the District Council waited on him to convey the thanks of the Council for the kind interest he had taken in all matters relating to the welfare of the town during his tenure of office. In a farewell memorandum, the retiring admiral expressed his thanks to all departments, officers and men for the efficient manner in which they had discharged their various duties. A change has been made in the destroyer flotillas in full commission. The vessels of the Second Flotilla have hitherto been tenders to the *Sapphire* and when the Fourth Flotilla was recently formed the same procedure was carried out. Now, however, they are to be tenders to the *Blenheim*, the parent vessel of the destroyers of the Home Fleet here. The newly-formed Fourth Flotilla has been very unfortunate, for in less than three months four of the boats have been damaged in collision—the *Recruit*, *Violet*, *Falcon* and *Colne*, the two former being at moorings when vessels drifted against them. The *Violet* could not be repaired here conveniently, so she was sent on to Chatham. The *Colne*, which came into collision with the *Falcon* while on the way from Devonport to the Medway in April, has rejoined the flotilla, the repairs to her bows having been completed. The damage to the *Falcon* was more serious. She had to be cut in two at the point where the collision occurred to enable the fore part of the vessel, which was several inches out of line to be eased back. Another destroyer which has come into dockyard hands is the *Sprightly*, which left on May 6th with eighteen other destroyers for a cruise in the North Sea. The same night her starboard propeller guard was knocked away and the blade of the propeller bent. Captain Carden, of the battleship *Magnificent*, has been selected for the command of the *Agamemnon*, and proceeds to Dalmuir to take charge of the new battleship, which will come here to join the Home Fleet, as will also the *Lord Nelson*. The three *Invincibles*, it is stated on good authority, will also serve their first commission in the Home Fleet at the Nore. That fleet will then be the most powerful combination afloat. The fifth Cruiser Squadron will soon be at its allotted strength. The *Leviathan* has arrived from Chatham, having had a thorough refit and has taken over the duties of flagship, which were temporarily performed by the cruiser *Niobe*. The new cruiser *Warrior* will be commissioned at Pembroke on June 1st, and when she joins the flag the squadron will comprise in addition to the two vessels named, the *Duke of Edinburgh* and the new cruisers *Natal*, *Achilles* and *Cochrane*. Doubtless when the *Invincibles* join next year, one of them will replace the *Leviathan* as flagship. The majority of the vessels of the Nore Division of the Home Fleet proceeded to Spithead for the review and subsequent cruise under Admiral Bridgeman. The vessels were the battleships *Bulwark*, flagship of Rear-Admiral Finnis, *Majestic*, *Magnificent*, *Victorious* and *London* and the cruisers *Cochrane*, *Duke of Edinburgh*, *Dido*, *Natal*, and *Charybdis*, in addition to the *Niobe*, which came from Devonport to act as flagship of Rear-Admiral Callaghan.

Pembroke Dockyard.

The launch of the *Defence* on April 27th was carried out with great success, the naming ceremony being performed by Lady Cawdor, who was accompanied by Lord Cawdor and a number of notabilities. When the ship was afloat three tugs took her in tow and brought her to Carr Jetty, where she will remain to receive her boilers and machinery and be fitted out. The last consignment of the main propelling machinery and boilers were received from Messrs Scott & Company, Greenock, on May 10th. After the launch a reception was held by Captain Superintendent Kingsford, who, it may be mentioned, has just been awarded a good service pension. The carved boxwood mallet and burnished steel chisel with carved boxwood handle with which the launching operation was performed were in a beautiful box, all the carving being the work of Mr. Thomas James, an established joiner. Mr. Miller, acting draughtsman, prepared a coloured picture of the ship as she will appear when at sea, and this and the box, mallet and chisel were presented to the Countess. Additional hands have been transferred from the *Defence* to the *Warrior*, so as to ensure her completion by the end of the month. The vessel will be commissioned on June 1st, and as soon as possible afterwards will leave for Sheerness to join the Home Fleet. Then only the *Defence* and the *Boadicea* will remain to provide us with employment. The latter vessel has not yet been started but her commencement will not be delayed very long. A quantity of mild steel plates from the Dowlais Works at Cardiff have arrived, but at the time of writing none of the high tensile plates for the first keel nor the Z angles for the frames have been delivered. The *Defence* will afford employment for nearly all hands if necessary, but it would be preferable to divert some to the *Boadicea* when the *Warrior* leaves. The conversion of the distilling and tank vessel *Aquarius* into a fleet workshop and repairship is now practically complete, as is also the refurnacing of the boilers. She retains her distilling outfit. It is interesting to note that when last employed she was manned by a civilian crew, but it has been decided that when she is again commissioned it will be by naval ratings. The Mayor of Pembroke, accompanied by the Town Clerk, visited London at the beginning of the month and waited on Mr. Owen Philipps, M.P., as a deputation from the Discharges Committee of the Town Council relative to the future of the yard. The Mayor has since been informed by Mr. Philipps that he has been in communication with the Admiralty, and has ascertained that there has been no change in the policy of the Government, nor was there any mention of discharges. It is probable that the Committee had been moved to take action because

of the prevalence of a rumour to the effect that three hundred men were to be either discharged or transferred to Devonport. The letter has been referred to in some of the local journals as being of a reassuring character.

ELECTRIC HEATING STOVES.

AN extremely well-illustrated circular has been published by Messrs. O. C. Hawkes, Ltd., of 69, Aldersgate Street, London, and Globe Works, Bromsgrove Street, Birmingham, dealing with their XL Patent Induced Draught System of Electric Heating Stoves. These stoves have been

Fig. 1

designed to overcome the various objections of marine engineers to the use of ordinary electric radiators on board ship. In the transformation of electric energy into heat for warming purposes the important point is to get the heat away from the stove in such a way that the air can be readily warmed and distributed to the apartment so that it can be uniformly heated. It is claimed by the manufacturers of the XL stoves

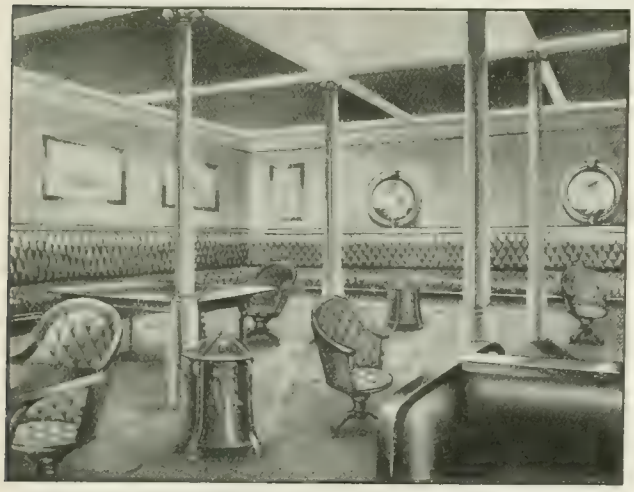


Fig. 2.

that they have accomplished this with most satisfactory results. The essential feature in these stoves is the provision of an induced draught of cool air which, in passing through the stove, is heated and distributed therefrom at about 400° Fahr. The outer cases of the stove are executed in a great variety of most artistic designs, one of which, the "Orient," we illustrate in Fig. 1, while in Fig. 2 a saloon is represented as heated by two stoves of the "Cowes" design.

It may be pointed out that lamps are not used for generating the heat, therefore no fragile replacements are necessary, and vibration does not affect the efficiency of the stove at all. There are no filaments to jar or to lock, and all the electrical connections made mechanically are fitted with lock nuts.

ELECTRICITY ON BOARD SHIP.

IX.*

By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc. M.I.C.E., Etc.

Distributing the Current.

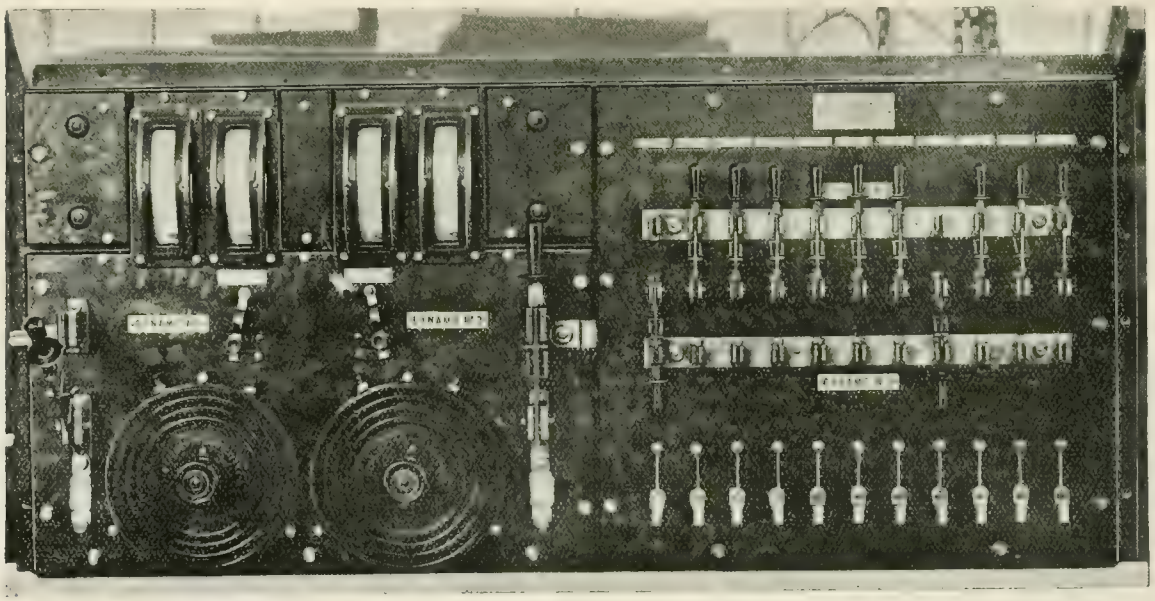
THE current is distributed by means of insulated cables from the main switch-board to the different parts of the ship. There are two methods of arranging the cables. It will be understood that the sizes of the cables required vary with the number of lamps to be supplied, and therefore will gradually become less as they recede from the main switch-board. Cables of comparatively large size will be connected to the main switch-board, and to them smaller sized cables, and to these smaller sized again, and so on till the smallest size is reached, the wires employed in delivering the current to the individual lamps, motors, or other apparatus. The successive branches of the cables are very similar to the branches of a tree, and the early method of arranging cables for distribution was known as the tree system. It is still employed to a certain extent. The tree system has one disadvantage in a great many cases, that is not so much felt on board ship as in houses on shore. Each branch where it joins the next larger cable must be protected by a fuse, and also sometimes has a switch there, and the points at which branches are taken off are sometimes in very awkward positions, which may even not be known. Such a case as the following may arise. A ship may be fitted up with electric light and power service on the tree system, and the man who takes charge of the installation when the ship first goes to sea, may know the position of all the fuses and the run of all the cables. But another man may take the original man's place, and he may not know the position of the fuses, etc. Some of them may have been placed in positions that are difficult to get at, particularly in cargo steamers, and occasionally in passenger steamers. The man in charge, if he is up to his work, will obtain the requisite knowledge in time, but meanwhile serious inconvenience may result from a fuse "blowing" in some out-of-the-way position, say in a hold after the cargo has been stowed, or in a cabin that is locked up, and the lights supplied by the cable protected by that fuse will be extinguished until the attendant finds its position and replaces it. This difficulty was felt very much on shore, where fuses were fixed, in the early days of electric lighting, under floors and in other positions where it was difficult to reach them, and their position was often unknown to the men who had to look after them. In consequence of this, the modern system has been developed, in which distributing points are taken in convenient positions, to which the first distributing cables are brought, and from which branches are taken to sub-distributing points, from which again smaller branches are taken, either to lamps or motors direct, or to branch distributing points, from which again still smaller wires or cables are taken to lamps or motors, etc. For purposes of distribution the ship may be conveniently divided into several sections, according to its size, and according to the number of lights and motors to be supplied. Thus, in a comparatively small ship, "forward" and "aft" will make convenient divisions, the distribution boards being fixed in the neighbourhood of the forecastle and of the after cabins. The exact positions will be determined by several considerations, such as the positions of

* For Articles I. to VIII. see last eight issues.

the lamps or motors to be supplied, the convenience of the situation itself for getting at, at any hour of the day or night, and the convenience with which cables can be run to them and from them. For larger ships there may be a forward section, an after section, a midship section, and again there may be further divisions, such as the forecastle section, the fore deck section, the after cabin section, the aft deck section, the saloon section, and so on. The same remarks apply to the sub-distribution boards, and to the branch boards where they are used. In fact, where this system is adopted, and before fixing the cables, the positions of the distribution, sub-distribution and branch boards should be looked out, and then the runs for the cables connecting them. It will be understood that by this method considerably more cable is used than on the tree system, but the very much greater convenience enjoyed in the matter of attendance and repairs, well repays the additional outlay. It is usually possible to arrange the runs for the cables between the distribution boards, so that they can easily be got at for examination and repairs. The distribution boards, sub-distribution and branch boards also, are usually convenient points, or can be made so, for connecting portable lamps, and those used in loading and discharging cargo.

return the negative cable. These names have fallen somewhat into disuse on shore, owing to the prevalence of alternating currents in towns. With alternating currents, as will be explained, each of the two cables is alternately positive and negative, and therefore the terms lead and return would be misplaced.

With both the single and double-wire systems, the tree method, or the point distribution method, may be employed, but it will be understood that with the single-wire system there is only one set of cables to be handled, one set of connections on the distribution, and sub and branch distribution boards, and so on. At the main switch-board, one or two bus bars may be used as convenient. The whole of the generators may be connected to the body of the ship, say through their own bed plates, or connections may be taken from their negative terminals to a negative bus bar on the main switch-board, and a connection from the negative bus bar to the body of the ship. The matter is one for the convenience of the engineer. Possibly the simplest arrangement will be, to "earth" each generator at its own bed plate, by connecting its own negative brush to the body of the machine. As explained above, the negative side of the distribution system is the return, and the



Main Switch-board, made by Messrs. Clarke, Chapman & Co., for two Dynamos, on the "Independent" system, the cable being on the single-wire system.

Single and Two Wire Systems.

In addition to the tree and point distribution methods, cables are fixed on board ship on the single and two-wire systems. On shore also there is a three-wire system. It has not so far been employed on board ship, but the writer proposes to describe it, since with the increasing length of ships, the increasing amount of power that is being distributed by electric motors, and the increasing advantage of reducing the sizes of cables, and the advantages that arise from using higher pressures with motors, it will probably come into use.

In the single-wire system, which was almost universally employed in the very early days of ship lighting, though it fell into disrepute to a certain extent at a later date, but which is still largely employed, a single conductor is used to carry the current from the main switch-board to the lamps or motors, and the body of the ship itself is made use of to carry it back again to the generator. In the two-wire system there are two distinct cables, both emanating from the main switch-board, one carrying the current to the lamps or motors, and the other bringing it back again. It is usual, on shore, to call the two cables the lead and return. With continuous currents the cable which carries the current outwards from the generator, is the lead, and the cable which brings the current back again is the return. The lead is also always the positive cable, and the skin and body of the ship therefore form the return path, and are connected to the negative terminals of the generators, either directly or through the main switch board. With the single-wire system one set of cables is carried from the main switch-board to the distribution boards, one set again of sub-distribution cables from there to the sub-distribution boards, and one set of wires or cables from the last distribution boards to the lamps or motors, the other side of the lamps or motors being connected directly to the body of the ship. One reason for the adoption of the single-wire system is its great simplicity, and the great convenience with which connections can be made. Since in modern iron built ships the body of the ship is found at every beam, every stanchion, and in fact everywhere, the lamp holder can be screwed directly on to say a beam or stanchion, the side of the ship, or any iron bulk head, and all that is necessary to complete the circuit, for the current to pass through the lamp, is an insulated contact in the lamp holder, connected to the branch distribution wire

Where the single-wire system is employed, what are termed central contact lamps are used, in which the base of the lamp carries a circular brass disc in its centre, to which one end of the lamp filament is connected, the other end being connected to the brass cylinder forming the cap. The lamp holder is also fitted with one plunger, supported by a porcelain or other insulating disc, fixed in the centre of the tube with which the

lamp cap engages when in position. When the branch wire is connected to the terminal screw of the lamp holder, and the lamp is pushed into its place, the circuit is complete through the lamp plunger, the brass disc on the bottom of the lamp, the lamp filament, the brass cylinder forming the lamp cap, the brass tube forming the lamp holder, the screw by which the lamp holder is held to the beam, stanchions, etc., to the body of the ship, and thence back to the generator. The switch controlling the lamp or motor must be fixed in the positive wire. The writer will discuss the advantages and disadvantages of the single-wire system, and explain a modification of it, in which the ship does not take part, in the next article. The illustration shows a main switch-board made by Messrs Clarke, Chapman & Co., for use with the single-wire system. It is arranged for two dynamos, working on the "Independent" system, described in the article in the April issue. The two "Independent Bus Bars," one for each dynamo, are shown, and eleven feeders, or distribution switches, of the two-way, or throw-over type. Two of the feeders are shown connected to No. 2 dynamo, and the remainder to No. 1. The switches for connecting each dynamo to the switch-board, and the adjustable rheostats for regulating the strengths of the currents in the magnetic field are also seen on the left, with switches and voltmeters above.

ELECTRICAL NOTES.

(From our Own Correspondent.)

IT is significant to note that the new Clydebank Dock recently opened by the Prince of Wales, is operated entirely by electricity. The inner basin is 1735 ft. long and varies in width from 302 to 330 ft., and provision is made for a trade of 4,000,000 tons per annum. The equipment will consist of four coal hoists and thirty-six cranes and a few transporters with capstans and other auxiliary machinery. The machinery includes two main generating sets and one lighting set. The coal hoists are each capable of dealing with 1000 tons of coal per hour, and of raising a total gross load of 32 tons to a height of 50 ft. in thirty seconds, the controlling gear being so arranged that the cradle is automatically brought to a standstill at any predetermined position, thus obviating the possibility of overcrowding or overtipping, and it is anticipated that the methods adopted of accelerating and retarding such loads may mean the general employment of electricity for dock work in the future. There being nothing of a similar character anywhere else the plant is in the main from entirely new designs and therefore of great interest.

Probably of all the systems of electricity as applied to lifting, the most unique is that of the application of the magnet for conveying bar iron and such pieces in a stock yard of such goods. So little extra machinery is required apart from the travelling and the motion, that such an apparatus is simplicity itself. The magnets drop to the required position, the current is turned on, the bar laid hold of, the lift follows and then the conveyance as desired, and the thing is done. As compared with hand labour a test has shown that while six men took half a day to do a certain quantity of work, the magnet attended by four men got through the same quantity of work in just one hour, which difference speaks for itself. It will be noticed that this type can pick up rails either hot or cold, which, of course, is a great advantage in this connection.

An ingenious system of danger signal for warships' turrets has been devised by Messrs. Evershed & Vignoles, of Chiswick, which provides a warning to a man in charge of a gun, and is intended to show with a trained gun if there is any danger before firing, either to another gun or to the turret itself. The arrangement is fitted in the *Dreadnought*, and is likely to be generally adopted, other vessels already being on the list to have the apparatus installed. It is not difficult to see that here is one of those cases where electricity can play an important part, as when the training of a gun gets into the danger zone it is made to register the fact, and in this case it is not only visual but audible, a trumpet sounding loudly, and on the right or left side of the man in charge according to the side the danger is on. The difficulty of the problem is from the fact that for a particular gun what is danger at one moment may be safety the next, as it depends not only on the position of a particular gun but also upon that of its neighbour.

Messrs. Holmes & Co., of Newcastle-on-Tyne, have lately fitted an electric light installation on the steamship *Rohilla*, belonging to the British India Steam Navigation Co., which consists of two generating plants driven by Paul compound engines of 100 B.H.P., working at 100 lbs. pressure and running at 450 revolutions per minute, coupled to a Holmes multipolar generator with an output of 685 amperes at 100 volts pressure. The switch gear includes two marine type voltmeters and ammeters, while the circuit switches, thirteen in number, are of the change over chopper type, so arranged that any circuit can be run from either machine. The double-wire system is used, and comprises 715 16 c.p. lamps, 69 12-in. fans and eighteen ceiling fans, while 5 2½-H.P. motors drive the ventilating fans. The wiring is carried out on the "distribution box" system, a pair of mains being run from each separate circuit switch to a section box fitted with fuses and switches, the branch circuits being further sub-divided into groups of not more than six lamps fed through special connection boxes. The cable used throughout is 1200 megohm quality and is protected in steel troughing arranged with a removable cover to give accessibility. The 'tween decks are well lighted, some 150 lights being fixed for use in the event of the ship carrying troops and admitting of being detached when not required for this purpose. A complete electric bell installation is provided in the first-class accommodation, and comprises 108 pushes ringing to indicators fixed in the pantries and smoke-rooms. The above gives some idea of the elaboration in this department, which has been attained on modern ships of to-day.

Iron and Steel Institute.—The Council has accepted a cordial invitation to hold the annual meeting of the Institute in Vienna on September 23rd, 24th and 25th. After the meeting there will be alternative excursions to Bohemia and Styria, by invitation of the Prague Iron Industry Company and the Austrian Alpine Mining Company respectively. An invitation has also been received from the Witkowitz Mining and Ironworks Company to visit their works. Remembering the great benefits derived from the highly successful meeting in the Austrian capital twenty-five years ago, the Council look forward with confidence to a renewal of past experience.

The Engineering and Machinery Exhibition, which is to be open at Olympia from September 19th to October 19th, promises to be a success, if we may judge from the arrangements which are so far made with intending exhibitors. The President of the Exhibition Committee is Sir Alex B. W. Kennedy, and the lists of Patrons and Committee contain so many important names that we may consider the interest to be both widespread and influential. Last year's exhibition was sufficiently successful in its results to justify a repeat on wider lines, and as a special feature of 1906 was an exhibition of tools, that of 1907 ought to be that of manufactured material—the product of tools.

The City (late Leask's) Academy of Marine Engineering, 4-5, High Street, Aldgate, London, E.C., have for years past established a reputation for their successes in all grades. We have been pleased from time to time to intimate to their old students their various successes, and now we have satisfaction in again reviewing the London passes for the April Extra Examination. There were ten candidates, six from the City Academy. There were six passes, five of them being claimed by that Institute. This without doubt establishes their position more securely than ever, for such results can only be attained by sound methods and individual tuition.

S. T. Taylor & Sons, of Newcastle-on-Tyne, have covered the boilers, pipes, etc., of the following vessels with their "Tynos" non-conducting material:—The S.S.'s *Komata, Ludworth, Admiral de Ruijter, Principe di Piemonte, Tirfing, Waihora, Maud, Snestad, Norfolk, Rotterdam, Braziliana, Blotberg, etc.*

Cochran (Annan) Donkey Boiler, with new patent seamless furnace, has been fitted on the following vessels:—*Easington, Thornley, Antonio Lanasa, Oyapock, Javary,* and *Ludworth.*

"GRAN CANARIA."

THE first steel vessel built in the Canary Islands made her official trial trip at Las Palmas on April 26th. This is the powerful and finely-modelled tug "Gran Canaria," which has just been completed by the Grand Canary Engineering Co., of Las Palmas, for the Grand Canary Coaling Co., also of that place. Her dimensions are: Length over all, 106 feet; length between perpendicular, 100 feet; breadth, moulded, 19 feet; depth, 11 feet.

Designed for the special work of the Grand Canary Coaling Co., and also for salvage purposes, she is strongly built of heavy scantling, with bilge keel 55 feet long by 9 inches deep, trimming tanks forward and aft, and 7 water-tight bulkheads, and is fitted with compound surface condensing engines, high pressure cylinder 17½ inches, low 36½ inches, stroke 24 inches, and steel boiler 12 feet by 10 feet for a working pressure of 130 lbs. For towing purposes she is equipped with strong vertical and horizontal posts, placed a little aft of centre of length of tug, carried down to within two feet of keelson, and well braced to the engine-room bulkhead, which is made extra strong. A slip towing hook is attached to the horizontal cylinder for light towing.

The trial trip was most satisfactory. Fully equipped and with her trimming tanks and bunkers full, the tug was run at 120 revolutions. The engines worked smoothly and well, and altogether the vessel displayed excellent sea qualities. The speed attained was 11 knots.

The "Gran Canaria" was designed and her building superintended by Mr. Thomas Edington, Superintendent Engineer of the Grand Canary Engineering Co. at Las Palmas.

Steel Tug *Gran Canaria's* Towing Posts and Slip Hook for light towing.

Steel Tug *Gran Canaria*, built by The Grand Canary Engineering Co., Las Palmas.

Joys' Patent Assistant Cylinders have been fitted to the S.S. *Laura*, and her sister ship; also to three other vessels being engined by Scotch firms.

New Zealand.—Through Mr. A. R. Hislop, Secretary for the Institute of Marine Engineers in New Zealand, and who is at present in London, we learn that the Institute in Wellington has purchased a freehold site for the purpose of erecting an up-to-date building for the use and convenience of members. The present premises are found to be too small, besides which it is the desire of our New Zealand brethren to offer accommodation and a home to all engineers visiting their colony, and to increase their already extensive sphere of usefulness, by making their headquarters an educational as well as a social establishment. We wish the engineers of New Zealand all the success their enterprise deserves, and hope from time to time to receive items for our columns, not only from New Zealand, but also from all officers of the Institute in Australia.

INSTITUTE OF MARINE ENGINEERS.

(*Continued from page* 376).

Exchange of Courtesies.—The following is an excerpt from a letter received from the secretary of the Australasian Institute of Marine Engineers, at Wellington, New Zealand, whom we are glad to welcome to our meeting here to-night.

"We are at the present time endeavouring to secure a building of our own in the centre of the city and close to the shipping, and if successful will be able to offer all your visiting members the entrée to a comfortable home when they are visiting the Colony."

A communication has also been received from the Institution of Engineers and Shipbuilders at Hong Kong extending an invitation to any of our members out in the East to visit their rooms, and assuring them of a hearty welcome either at Hong Kong or Shanghai, where they have comfortable premises. It may be added here that Mr. Macdonald, one of our members in China, has been instrumental in obtaining several new members.

Owing to the success attending the Engineering Exhibition at Olympia last year, another exhibition is being arranged to be held in September this year. It is hoped that the competition arranged for the Junior Section last year under which essays contributed by graduates on "A Visit to the Engineering Exhibition," two of which were deemed worthy of award, may be arranged on similar lines in connection with the forthcoming exhibition. A grant of £50 was made to the Institute for benevolent purposes as one result of the success of the exhibition.

The President of the Board of Trade having invited the Institute of Marine Engineers to nominate an experienced marine engineer to act on the Advisory Committee which the Board of Trade is empowered to appoint in connection with the Merchant Shipping Acts, the Council nominated Mr. George Shearer. This nomination has been accepted by the president, and Mr. Shearer has been advised.

The system inaugurated during the session of issuing the transactions in monthly parts and of adopting the principle of admitting advertisements within the covers in order to compensate for the additional expense, has proved to be very satisfactory, and it has commended itself specially to many members abroad, who have hailed the change as a means of keeping them in closer and regular touch with the proceedings of the Institute, a testimony which is a welcome one to all who have the interests of the membership throughout the world at heart, with the desire to maintain and foster that kinship of purpose which will tend to advance the intention and scope of the founders of the Institute, as set forth in the Articles of Association, to increase the membership and generally bring about the greatest good to the greatest number with the least expenditure, a consideration it is necessary to weigh carefully to avoid any increase in the annual subscriptions and aim at efficiency with economy.

Mr. A. H. Mather, hon. treasurer, in submitting the balance-sheet, said: In placing before you the statement of the financial positon of the Institute at the close of the year 1906-7, I am pleased to be able to report that the position is entirely a satisfactory one in every respect save one, which is accounted for, as is mentioned in the chartered accountants' letter, by the large amount of subscriptions in arrears. This increase in the amount of arrears can, I think, be accounted for by the fact that during the last year the usual routine of notices to members *re* subscriptions was not thoroughly kept up. For a considerable part of the year, during which these notices should have been sent out, we were without the services of an assistant secretary, and this part of the work had to be curtailed for the time being. Now, however, this department is again in working order and I expect to see the whole of these arrears brought up. This subject of arrears has been referred to over and over again by my predecessors in the office of honorary treasurer, and I can only express the hope that members will not wait for the notices, but just send their subscriptions along when they are due.

Before sitting down I should like to express my thanks to Mr. Ross, the hon. financial secretary, for the help he has given and the amount of work he has done; especially during the time we have been without the services of the assistant secretary, when all the work of the Institute has had to be done by the honorary officials, he has put forth a great deal of time and energy in that work.

In listening to the remarks of the secretary of the Australasian Institute it made me think that having such a very energetic Institute at the other end of the world should act as an incentive to us to put our Institute on a better footing than ever. According to the numbers mentioned by Mr. Hislop it seems to me that their Institute is considerably larger than ours in view of the number of members here. My Lord President and gentlemen, I think it would be a very good thing if this occasion were taken by some of the gentlemen connected with the Institute, who did a great amount of work in putting the Institute on a firm foundation in years gone by, to put their heads together again, as in my opinion the time has arrived when another step is not only advisable, but necessary, to put the Institute well ahead.

Sir Fortescue Flannery, in the course of his remarks, said "My Lord President, Sir Joseph Ward and gentlemen, in rising to move the adoption of the reports of the honorary secretary and honorary treasurer, I think the Institute may be congratulated upon two important facts, first, the renewal of brotherly feeling and friendship with our comrades on the other side of the world, the Marine Engineers of Australia and New Zealand, and secondly, upon the practical progress which we as an Institute have made, notwithstanding some considerable drawbacks which have been already alluded to in the very clear statements of the honorary secretary and the honorary treasurer. We have not only continued our lectures, but we have continued our dances and our concerts. We have not only a coal testing machine, but we are now as an Institute the proud possessors of a piano, and in that way we are combining amusement with instruction, we are combining the lighter side of life with solid scientific progress. I believe our Institute in that way is working in the right direction. It is no use saying that our younger members should give all their time to classes and to hard studying; many of them, coming home from long voyages, are naturally desirous of some recreation, and it is to my mind a valuable and useful feature of this Institute that we are able to offer social attractions, visits to works and exhibitions, the opportunity of reading all the scientific journals and of coming in closer contact with their brother members, as well as the more solid attractions of scientific lectures. The Institute has certainly made progress in its official recognition by the Government of the country. The Institution of Naval Architects, the Institution of Civil Engineers, Mechanical Engineers and other institutions have been recognised by the Board of Trade in past years as being competent to nominate a representative upon the Advisory Committee and other committees which administrate through the Government the affairs of the mercantile marine, and I believe I am right, my Lord, in saying that this is the first time that the Government have recognised officially the Institute of Marine Engineers by allowing them to nominate a representative on the Board of Trade, and that therefore we have passed one of the landmarks in the history of this Institute and have attained to an official position which we have long deserved, but which, up to the present, has not been accorded to us. We shall prove ourselves, I feel certain, worthy of that confidence, and we have certainly sent a practical representative to the Board of Trade who will do credit to the Institute and who will be very useful to the Board of Trade, in performing those important duties. My Lord, I move with the greatest pleasure the adoption of these reports. I believe that our Institute will go forward and prosper and will be even more useful to our members in the future than it has been in the past. May it continue to form a connecting link between the distant parts of our great Empire, and may it reflect in brotherly feeling, in the sense of comradeship, the splendid patriotic idea which is embodied in the words of Sir Joseph Ward and his colleagues upon the Committee for Mercantile Progress, when they said that they feel as if they are coming home, and Mr. Hislop, in coming to this country for the first time in his life is coming, not to a strange land, but to the bosom of their mother, coming home amongst their countrymen and their brethren. Long may that feeling continue, and may we ever consider it our duty, privilege and pleasure to successfully promote that

splendid feeling of brotherhood which permeates our countrymen in all parts of the world.

Mr. A. E. Battle: It naturally gives me great pleasure to second this motion, and that pleasure is accentuated on this occasion by the fact that I owe to New Zealand practically all my education as an engineer, and therefore when I see these faces around me and hear the words that have been spoken by our brethren from the colony, it fills me with pleasure and proves to me that New Zealand has produced men of a practical character and is capable of producing engineers of the first order. I will say that one thing I do regret is that I am unable to welcome the New Zealanders to our country in true New Zealand style, but still I have been very pleased to see our friends and to hear all that Mr. Hislop told us about the success of their Institute. Both of the statements put before us to-night by the honorary secretary and honorary treasurer are most decidedly satisfactory, and as these have been so ably dealt with by Sir Fortescue Flannery, I have nothing more to add on this subject. There is one thing I would like to mention in connection with the Olympia Exhibition which is to be held this year. Mr. Adamson in his report refers to the essays contributed by graduates at the last exhibition and expresses the hope that a competition on similar lines will be held for the Junior Section this year. I may say that I shall be only too delighted to present the awards on this occasion also. I have much pleasure in seconding the motion.

Lord Pirrie: I am sure you will excuse me for going outside the programme drawn up by asking Sir William White to support this proposal.

Sir William White: Lord Pirrie, Sir Joseph Ward and gentlemen, I would like to explain that when I received an invitation to come this evening, I felt that it would be impossible for me to do so, but although I could not come in time for the dinner I felt it was the right thing to indicate my continued interest in this Institute, of which I was president so many years ago, and my great respect for the retiring president, Lord Pirrie, by coming to this annual meeting. I join in everything that has been said as to the progress made by the Institute, but I want to say again a thing which I said at the last annual dinner of the Institute I had the pleasure of attending, and which in a way has been said already by the honorary treasurer in his concluding remarks, that in my judgment this Institute is not making the progress in membership it ought to make. What I mean is this, that when one considers the enormous body of marine engineers in the British Mercantile Marine, and then takes the membership of this Institute, it is perfectly obvious that the number of members of the Institute ought to be much more than it is, and in some way or other steps should be taken to secure that accession of members. As to the way this is to be done it is not for me to make the suggestion, but that it should be done there is not the least doubt. If my memory serves me right the membership numbers about 1000, but if the old scale of growth had continued this number would have been greatly exceeded. I hope you will take these remarks in the spirit in which I am making them; it is my interest to see this Institute flourish. I suppose, without egotism, I may say that I have been president of more institutions than any one living, but this was my first love, I was first elected a president of the Institute of Marine Engineers a good number of years ago, and it has a warm corner in my heart. I was the last president to endure the martyrdom of giving his presidential address at the annual dinner. Having done so I "struck" and protested against such an arrangement, and this has never been done since. But the pith of my address was this, that great as was the skill of the engine designer, yet after all the working of the machinery on British ships depended upon the human element. I have heard that phrase "the human element" quoted a good many times since then, but it is the truth, and for your own sakes take care not to overlook it. If the "observational" engineer is going to take charge I would rather not be on board of that ship, but it is for you all to put your interest into it, to get your friends to join and to get new recruits among your comrades in the mercantile marine. That is all I wish to say on this subject, and it is said with the best intention and the kindliest feeling. I will only add one word with regard to our visitors from the other side. I well remember that dinner when Sir Fortescue was presented with the emblem by Mr. Seddon on his initial appearance immediately after his arrival in this country, and I remember that I had, on that occasion, to propose "The Houses of Parliament," a subject of which I knew nothing and was therefore able to speak with great freedom. However, I ventured to say that considering the wear and tear of the Parliamentary machine in this country through all the centuries it does its work fairly well. It is something like the Cornish engines in the mines, somehow or another it gets through the work, often with a lot of clatter, now and then stopping altogether, but sometimes working overtime. But the amount of work they do is nothing to what has been done in New Zealand; the highest degree of Parliamentary endurance is to be found there—a thirty hours' sitting is, I believe, a late record. But I went on to say that behind it all there was a power of performance which no newly designed machine could possibly do, that by sheer wear and tear they had at least a machine that could be driven and behind it all there was the people's will, and that was the thing that "fetched" Mr. Seddon, for after that we heard a good deal about the "people's will." We were all greatly impressed with his personality and all respected the man who, amongst many difficulties, always kept in the forefront the desire to serve the new nation of which he was the Prime Minister. After all he was an Englishman, and I suppose our friends in New Zealand do not object to be called Englishmen. They are the representatives of the Empire in the Southern Seas, and we believe that the important event which is about to take place will help to make the Empire not merely world-embracing but all-enduring.

The motion was then put to the meeting and carried.

Mr. A. Boyle then proposed and Mr. T. F. Auckland seconded a vote of thanks to the retiring President, Lord Pirrie.

The Honorary Secretary: I am sure, gentlemen, before putting this vote of thanks, that we should like to hear a word or two from Mr. Mills, who has come to this country to represent the colony at the forthcoming Maritime Conference.

Mr. James Mills: My Lord and gentlemen, as Mr. Adamson has said, I am here to-night, along with Sir Joseph Ward and Mr. Hislop, as one of the representatives of New Zealand in connection with the Maritime Conference, and also as an Associate of the Australasian Institute of Marine Engineers whose badge I am proud to wear. I am glad to have this opportunity of speaking in support of the vote of thanks to your worthy and noble president. On behalf of the New Zealand visitors I take this opportunity of thanking him for his hospitality to-night and also to thank the Institute for the invitation. I cannot add anything, of course, to what has been said in connection with your noble president, but I feel sure from the character he has always borne for energy, that his services have been valuable indeed. The name of Lord Pirrie is, of course, well known to us in New Zealand, in which country he is a prominent figure in shipping and commerce, in connection with his famous firm, and we enjoy the services of some of the noble ships built by his firm in the trade between New Zealand and Great Britain. They occupy a prominent place in the shipping of the country and are a source of great pride to the colonists. I am pleased to be associated with Sir Joseph and Mr. Hislop in representing the New Zealand Institute of Marine Engineers, and I am glad to have heard from some of the speakers the progress of the New Zealand Institute referred to in such a flattering manner. That the Institute is so flourishing is largely, or I should say, almost entirely due to the efforts of Mr. Hislop. He has shown such industry, such judgment, and above all, such tact in his dealings with the engineers and his dealings with the employers, that he has succeeded in building up a strong institution, which is doing a good work not only for itself, but in the confidence of the employers, who are proud to contribute in any way in their power to the success of the institution. It has been mentioned that the Australasian Institute, of which New Zealand is a section, numbers from 1400 to 1500 members, while the New Zealand Institute itself numbers about 400. My personal connection with this Institute is very intimate, as in the employ of the company of which I have the honour to be the head there are something like 220 engineers, whose wages amount to about £50,000 per annum. Of course, I have not the privilege of coming into contact with all of these, but I do meet a good many of them, and it always gives me great pleasure to work with Mr. Hislop on their behalf. We look upon the New

Zealand engineers and their brethren in Australia as a very able and capable body of men, who carry high ideals of their work in their minds, and who look upon it as their personal interests to study the interests of their employers. I hope the Institute here will continue to flourish and add to its numbers, and it seems to me that in a country where there are 20,000 to 30,000 engineers the numbers should be very large indeed. I need hardly say that the Institute has the best wishes of the New Zealand engineers. It has given me great pleasure to be here and to be the guest of the president along with the members associated with the Prime Minister of New Zealand and Mr. Hislop.

The resolution was then put by the Honorary Secretary and carried with acclamation and musical honours.

Lord Pirrie suitably replied.

Mr. Robert Leslie: Lord Pirrie, Sir Joseph Ward and Gentlemen, I am very pleased to be here to-night, and I am also pleased to see such a number present. Time is going and I certainly won't inflict upon you a long speech, but I have a little duty to perform. It is an easy one and I hope it will be accepted by all present, that is, to propose a vote of thanks to the retiring office-bearers and council. As Lord Pirrie has just said, the principal part of the work depends upon the Council, and I certainly hope, with Sir William White, that a little more of the "high pressure" will be thrown into the work of the Institute, so that we can say we are going ahead, as when anything comes to a standstill it begins to go downhill. I believe in going ahead, and I earnestly hope that the members of council and all the friends they can bring to bear round about them will do their level best for the sake of the old Institute. I will only call upon you now to give a hearty vote of thanks to the Council and office-bearers, and I have great pleasure in coupling Mr. Adamson's name in that vote.

Mr. C. Slater: My Lord President and Gentlemen, after listening to the remarks from Mr. Leslie, I am sure you fully endorse his sentiments of our appreciation of the services rendered by the retiring Council and office-bearers, and I have much pleasure in seconding that vote of thanks.

Colonel Denny: I am very pleased to support the resolution in appreciation of the excellent work done by the retiring office-bearers and council, but I really wish to say a few words because I have achieved a false character. Lord Pirrie has given me the reputation of having learned to speak, whereas he has for his motto, "deeds not words." I wish to correct any false impression that might be given, as I fully agree with him that the influence of deeds is far more potent than that of words. All I wish to say in support of this resolution is that I was once president of this Institute, as my father was before me, and in my case I saw that it was upon the officials, and particularly upon the honorary secretary, that the work of the Institute rested. We owe a debt of gratitude to Mr. Adamson; all through my term of office and during the time I have been connected with the Institute his work has been of the most admirable description. He showed the world of marine engineers their real worth and put before them the object of obtaining as perfect a grasp of their art and science as possible, and it is in a great measure due to him that we have the class of marine engineers we have. In these times, as Mr. Leslie has said, it is perfectly true that we must keep going ahead; in the words of the American it is a case of "get on or get out." We have new engines and new machines coming in every day, the old reciprocating engine has given place to the delicate turbine, now we are threatened with the gas engine and soon the oil engine will be a serious competitor with both. We will shortly have to devote a special branch of engineering to the production of aeroplanes, and I am not sure even whether the aeroplane will not displace the waterplane, but one thing is certain—this Institute must not stand still. We must remember that the ship has contributed in a great degree to the position of this country and by the ship this position must be maintained. And here the "human element" enters; the command of the ship does not rest with the "captain of the bridge" or the "captain of the foretop" and all the other captains—these have all passed away now, the real commander of the ship lies below in the engine-room, and unless we get men prepared to occupy themselves in doing this work thoroughly and creditably, the work of the shipbuilder will be largely thrown away. We look to you, gentlemen, to do our work credit and to keep this country in the position it is in at the present time, and that is why I have great pleasure in supporting this vote of thanks to the men who have made this Institute what it is, and I hope their successors will carry it on as well as they have done.

The Honorary Secretary: My Lord President and Gentlemen, it will be of interest to read the card which has just come into my hands to-day, not from New Zealand, but from the United States of America.

> "The Institute of Marine Engineers is cordially invited by the trustees of the United Engineering Society representing the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers, to participate through an authorized representative at the dedication of the building given by Mr. Andrew Carnegie, as a home for American Engineering Societies, at 29, West 39th Street, New York, on April 16th and 17th, 1907."

That, gentlemen, is evidence of a fact that has been accomplished in America and which our own societies in this country have advocated for some years past. I can only hope that the advent of this card into this country may be the means of stirring up our own institutions to establish a similar building, so that on an occasion such as this we shall have a representative building in London where all the institutions of the country can meet and have their annual meetings and annual dinners, and by that means establish a brotherhood amongst those institutions which does not at present exist. And now, gentlemen, on behalf of the retiring office-bearers and council, I thank Mr. Leslie, Mr. Slater and Colonel John Denny for the expressions they have used in placing before you for acceptance this vote. I also thank you for your acknowledgment. The nature of the work which has to be accomplished to carry on the operations of the Institute can only be realized by those who are in close touch with it, but a study of the synopsis of the meetings held during the year will give members some idea of what is necessary to carry into effect all the details involved in the programme, and at the same time it also shows that those to whom you have accorded this vote require to devote more than a passing attention to the affairs of the Institute, otherwise that continuity of policy and action which is so desirable in carrying out organized work, especially when that work is voluntarily performed, cannot be maintained. While it is desirable, as set forth in the footnote on the circular calling the annual meeting and the votes of the members, that the office-bearers and members of council should be regularly devoted in their attention to the duties entrusted to them by the members, and the evidence that they as a whole have been so devoted may be assumed as comprehended in the vote of thanks now accorded to them, I hope I shall not be presuming too far on your indulgence by viewing the position from another standpoint, in view of Mr. Leslie's words, which would have introduced another item on our programme this evening, that item to be a vote of thanks to the general membership, proposed by the council, as I apprehend that although the office-bearers and council are elected by the members, their interest does not end there, nor does it end here with a vote of thanks. We expect members to take an active interest in the work and assist the council in that spirit of co-operation and loyalty which will ensure the highest result and the greatest good. It has been said that the best form of thanksgiving is thanksliving and any one who professes to have a sense of gratitude —save in the cynical form which it is said too frequently to assume—should show it by his actions, as by them his sincerity can be gauged. On the one hand, therefore, it behoves the office-bearers and council by their attendance to the affairs of the Institute to show their appreciation of the confidence reposed in them by the members, and it behoves the members to show their appreciation by backing up the efforts of their representatives. A vote of thanks may be merely a formal acknowledgment of services rendered—a few passing words and it is over. It seems to me, it has ever seemed to me in connection with this Institute, that such is not a true appreciation of what is implied under this heading at our annual meeting, as it is undoubtedly capable of a much higher interpretation and of a much higher appreciation, and involving as it does the vital fires which keep our aspirations alive, the view presented to my mind, and I believe to the minds of my colleagues, is that your vote of thanks is an inspiration, that while the work of the past year has justified your confidence, it is by no means

implied that we should rest upon our oars but go forward, with increased desire and enthusiasm, improving upon the past, encouraged by the thought, buoyed by the hope that you are all co-workers with us in advancing the Institute of Marine Engineers and making it helpful and elevating to every grade of its membership as well as in proving to the general public, as Colonel Denny has indicated in his words, that a marine engineer is not necessarily a man whose only knowledge consists of that of the three R's and capacity to use a hammer and chisel. Let us be united and loyal to the progress of the Institute and by so doing we will carry into effect the words uttered by Sir Wm. White, Mr. Leslie and Colonel Denny. While we think and say that we have not progressed in the past as we might have done, we hope in the future to accomplish better things. We are not of those who desire things to come to a standstill, our motto is "progress," and if every member of the Institute will support the office-bearers and council I am quite sure of this, that we shall make this Institute second to none in the country. Ere I sit down, I would refer in a word or two to the hope expressed by Mr. Hislop that in the future there would be papers emanating from the Australasian Institute. Gentlemen, a paper has emanated from that Institute already, I have it in my possession and I am glad to think that it is written by one of our own members, one who is a member of this Institute and also of the Australasian Institute. I thank you for the vote that has been passed, and as far as the members of council of this Institute are concerned, we shall go forward doing our utmost to bring ahead the Institute of Marine Engineers, but we ask you, upon whom much depends, to back us up and to help us as far as you are able.

Mr. W. Lawrie and Mr. Asplan Beldam proposed and seconded a vote of thanks to the chairman for the able and genial manner in which he had conducted the business of the annual meeting.

The proceedings then terminated.

OBITUARIES.

Walter Brock.—Intimation of the death of Mr. Walter Brock, senior partner in the firms of Messrs. Denny & Co., and Messrs. Wm. Denny & Bros., at Dumbarton, on April 26th, was received by a large circle of engineering and other friends with a shock, although it was known that he had been ailing and had exceeded the allotted span of three score years and ten. A tribute of esteem is due to the memory of Mr. Brock—to his great personality, and it is fitting that a paragraph should be devoted to record a few passages from the life of one who has gained the respect and esteem of all who came in contact with him; as one of his partners expressed it in epitomised terms, in conveying the intelligence of his death, in the words, "I know you will be grieved to learn that Mr. Brock died yesterday morning. It is a sad loss to us, and the close of a great and good life." Such a testimony from one who had grown up under him from youth to manhood may be taken as representative of one who has lived his life and done his duty to his generation. He also extended his interest in those employed by the firm beyond the confines of the machine shop, in many directions, quietly and unobtrusively. Without appearing much in public or apparently taking part in any concerns beyond the works, Mr. Brock was ever ready to help a good cause, aiding the active workers in connection with many organizations by kindly words and financial help. Mr. Brock commenced work and gained the rudiments of his engineering experience with a firm, knowledge of the name and reputation of which is fading into a tradition, Robert Napier & Son. Subsequent experience at Brest and London, with a growing reputation, led him to Dumbarton, where in 1871 he joined the late Peter Denny, LL.D. in the firm of Messrs. Denny & Co., and later on he became a partner in the shipyard firm, Messrs. Wm. Denny & Bros. His talent and abilities as a reliable practical engineer soon caused him to be looked upon as one of the foremost men in the engineering world, while the share he took in the progress and advancement of marine engineering during the transition from 60 lbs. to 180 lbs. steam pressure, with the consequent development of the engine, showed him to be full of zeal and courage in moving forward. Not only in connection with the advance of the reciprocating engine was Mr. Brock concerned; he was largely instrumental in introducing the turbine for marine work, as with him rested to a great extent the decision which resulted in the *King Edward* being placed as the pioneer steamer running on the Clyde to prove the commercial success of turbine machinery. Following upon the successful running of the *King Edward*, negotiations were entered upon and details worked out for other steamers with a high rate of speed for cross-channel as well as for ocean-going service, notably those of the latter class for the Union Steamship Co. of New Zealand and the British India Steam Navigation Co. These steamers Mr. Brock had the satisfaction of seeing in successful operation and of knowing that the results were satisfactory after a series of voyages, thus crowning his own work and labour in connection with the adoption of turbine machinery. His interest was not confined entirely to the inside of the works, which grew and increased after his advent to the active management; our recollection and

Photo by Wm. Blain, Dumbarton.

The late Mr. Walter Brock.

experience of many interviews enkindle anew the regret that no more shall his voice be heard among those who were wont to gather from time to time under the hospitable roof in the shipyard at Dumbarton. The father of Mr. Brock was a banker and a well-known citizen of Glasgow, so that the line adopted by Walter as a boy was not due to tradition, and the choice made was justified by the keen interest he maintained up to the last in engineering questions; his business was also his hobby. Besides being connected with purely local societies, he was a member of the Institution of Engineers and Shipbuilders in Scotland, which he joined in 1865, when the Scottish Shipbuilders' Association, of which he was a member, was incorporated with the Institution. He was a vice-president of the Institute of Marine Engineers and when that society set about procuring a building to call its own sixteen years ago, Mr. Brock showed his sympathy by subscribing towards the fund, under the presidency of Lord Kelvin. His benefactions to the funds of the local hospital at Dumbarton and to the hospitals of Glasgow show that his sympathy was wide and that he was

mindful of the claims of suffering humanity. It was also a satisfaction to him when his son Henry was appointed on the committee to consider as to the suitability of turbines for the new Cunarders. The early death of this son was a very great blow to his father, so that the cup of satisfaction which appeared nearly full was mingled with bitterness, illustrating the incompleteness of human effort and the breaks in continuity which occur even under circumstances where it would appear most desirable to have it otherwise. He has left a son and daughter in sorrow; the former is named after his father and is in the business to maintain his name and reputation.

Henry M. Rait.—It is with great regret we record the death of Mr. Henry M. Rait on May 2nd. He was an engineer well known on the Clyde thirty to forty years ago, and after he left the works, of which he was senior partner, at Cranstonhill, Glasgow, and came to London, twenty-nine years ago, he commended himself to all he was associated with by his

Photo by Bassano, London.

The late Mr. Henry M. Rait.

kindly demeanour and pleasing personality. He was a member of several engineering societies, and was one of the early members of The Institute of Marine Engineers, and his firm contributed £25 towards the building fund of the Institute when their present premises were purchased. Mr. Rait served his apprenticeship of five years, 1855 to 1860, with Messrs. James Aitken & Co., Cranstonhill Foundry, Glasgow, after which he was sent out to Russia to fit up the pumping engines for the St. Petersburg Waterworks, which were made at Cranstonhill. On returning he was employed by the firm as chief draughtsman until he joined the Greenock Foundry Co. He was afterwards appointed superintending engineer of Messieurs Valery, Frères et Fils at Marseilles, where he remained four years. On his return to this country he became superintending engineer of the Inman S.S., Co., Liverpool, and subsequently became managing partner in the Greenock Foundry Co. In 1871 he became senior partner of the firm of Rait & Lindsay, successors to Jas. Aitken & Co., of Cranstonhill Foundry, Glasgow, until January, 1878, since when he has been senior partner of the firm of Rait and Gardiner, engineers and dry dock owners, of 155, Fenchurch Street, E.C., Millwall Dock, Albert Dock, Tilbury Dock and Cubitt Town. He was educated at the High School of Glasgow, Neuwied-on-the-Rhine and Glasgow University, where he studied mathematics under Prof. Blackburne and engineering under Prof. Macquorne Rankine.

Andrew Brown.—We regret having to place on record the death, in his eighty-second year, of Mr. Andrew Brown, head of the old-established and world-renowned Renfrew dredger-building firm of William Simons & Co., Ltd. The event took place at his residence of Castlehill, Renfrew, after a comparatively short period of illness, on the afternoon of Monday, the 6th May. Although all through life an earnest thinker and hard worker, deceased was yet in exceptional vigour, both physically and mentally, until a few weeks before the end, and was then paying his customary daily visits to the offices and works over which he has so long presided. Contracting a chill, however, lung trouble arose, and other serious complications supervening, he passed peacefully away on the date stated.

By the death of Mr. Brown, the Clyde has lost its oldest, and one of its best-known and ablest engineers and shipbuilders, and the burgh of Renfrew a staunch friend and liberal benefactor. In his demise, too, one of the very few—perhaps the last indeed—of the remaining links with the early days of marine engineering and steamship construction on the Clyde has been severed. Born in the Gorbals district of Glasgow in October, 1825, deceased was early "put on his mettle" as a worker. At the age of fourteen he began his apprenticeship as mechanical engineer with Mr. John Neilson, of the Oakbank Foundry, Glasgow. After having served the usual period he became assistant mechanical draughtsman and foreman pattern maker at the works of Messrs. Wm. Craig & Co., marine engineers—formerly Claude Girdwood & Co.—at a time when the drawings were made on the board for the patterns. Transferring his services, after two years, to the firm of Tod & Macgreggor, engineers and shipbuilders, Partick, he had experience in designing and draughting of engines for Peninsular and Oriental and other steamers. For a short time after this he was engaged in the St. Rollox works of the Caledonian Railway Company, gaining there under Mr. Sinclair, C.E., valuable experience in the locomotive branch of engineering.

While keenly interested in all its branches, Mr. Brown's special bent, however, was in the direction of the marine side of engineering. His opportunity of doing original work came in 1850, when he was appointed engineering manager to Messrs. A. & J. Inglis, Whitehall Foundry, Glasgow. In the service, and under the inspiriting influence of Mr. John Inglis—who, with his brother Anthony had founded this firm in 1847—Mr. Brown, then in his 25th year, evinced sterling talent as a designer of engines, and organizer of practical operations in the shops. Associated with a man of Mr. John Inglis' enterprise and fertility as an engineer, he acquired wide experience which, combined with his sound practical mind and great energy, proved most valuable in his future work. During the ten years he was associated with Messrs. Inglis, he had to do with the designing and completion of a large number of marine engines of various types. Here it may be appropriate to state that Mr. Brown was amongst the first to see and appreciate the advantages of the link-motion type of valve gear, and that he was one of the pioneers in the introduction and fitting of this gear to marine engines. To catalogue the varied kinds of engines, for the design and construction of which he was largely responsible while with the Inglis firm would be difficult, but it may be recorded that in 1850-1851 engines from his design were fitted on board the towing steamer *Clyde* (the same steamer, but with other machinery, still doing service on the river), consisting of a pair of disconnected, and entirely independent engines driving the paddles; an arrangement which allowed the engines to be worked separately, and in opposite directions, intended to facilitate turning. Amongst other work in 1851-1852 upon which he was employed, were two pairs of geared beam engines for screw steamers for service between Leith and London—the first on this route. Later, Mr. Brown was responsible for the construction, amongst other engines, of a set of three-cylinder direct-acting engines of 3,000 I.H.P. which were fitted with outside slide valve, steam-starting gear, and "built" crank-shaft, features

which have often been considered as dating from times more modern.

In 1860, Mr. Brown was invited to join the late Mr. William Simons in partnership, at Renfrew, in carrying on and extending the business of shipbuilding and engineering, which since 1810 had been conducted at Greenock and Whiteinch. Mr. Brown had been engaged on dredging machinery at Messrs. Inglis' works, including plant to work at 37 ft. draught, which at that time was considered "prodigious." He was, as a consequence, influenced to make this practically a speciality of the Renfrew works, and the fruits of his study of, and experience and ingenuity with, the engineering problems relating to steam dredgers and dredging plant, have given his own name and that of the firm with which he has been so long identified, a world-wide reputation. Between 1861 and 1863, he designed and constructed four self-propelling hopper barges for the Clyde Trustees—the first vessels of their type constructed in this country. From 1866 to 1872, his firm turned out eleven bucket ladder dredgers—stationery and propelling—for various home and foreign ports, including one—No. 9—for the Clyde Navigation Trustees. The experience gained in the construction of these hopper steamers and bucket ladder barge-loading dredgers suggested the utility of combining the properties of a ladder dredger and a hopper barge in one hull. After much study of this point, Mr. Brown invented and patented the type of vessel now known as "hopper" dredger. The first hopper dredgers were the *Canada* and *St. Lawrence*, vessels of 200 tons and 700 tons hopper capacity, constructed in 1872 and 1874 respectively for the Canadian Government. Mr. Brown in 1888 further improved his design of hopper dredger by inventing the stern-well type of hopper dredger, a design much in favour with the British Admiralty, for whom the Messrs. Simons have constructed half a dozen dredgers of this type. In the original design of hopper dredgers, the bucket ladder was led through a central well opening at the bow, but in the stern well dredgers the ladder works through a central well opening aft. The advantages thus gained are obvious, as by having a closed bow, as in stern well dredgers, a form of hull better adapted for withstanding rough and stormy weather, and better steering and steaming qualities, are obtained.

Since the introduction of hopper dredgers, Mr. Brown had to do with the designing and construction of dredgers ranging from 150 tons to 3,000 tons hopper capacity, with a dredging capability of from 100 to 10,000 tons per hour. The pioneer sand pumping apparatus employed on the Mersey, which paved the way for the large pump dredgers now owned by the Mersey Docks and Harbour Board, was one of his early productions. The large fleet of powerful suction dredgers now employed at Durban were all supplied by his firm, the first dredger employed there being the *Beaver*, built in 1889, followed a few years later by the 2,000 ton pump hopper dredger *Octopus*, and in quick succession by other pump dredgers of hopper capacity up to 3,000 tons. The improvement effected by these dredgers may be appreciated from the simple statement that whereas a few years ago the bar at the mouth of Durban Harbour blocked the entrance to the port, unless for shallow draught vessels, the port is now open to the largest mail steamers which can moor alongside the wharves. Reference might be made to bucket hopper dredgers and other plant supplied by the firm and employed in the work of improvement at Durban, as well as to suction hopper dredgers supplied to the port authorities and effecting great improvements at East London, but to instance all the achievements of the many dredgers which have emanated from the Simons works would simply be to enumerate most of the improvements made in recent years on ports and water-ways in Britain and its colonies, as well as in foreign countries.

Although devoting much time and study to the construction and designing of many different types of dredger plant, Mr. Brown never entirely confined himself to this particular branch of engineering. Thus in 1861, he designed and constructed the Clyde passenger paddle steamer, *Rothesay Castle*, which obtained the then remarkable speed of 20¼ miles per hour. It is a noteworthy fact that forty years later this vessel, under a different name, was still in employment on the Canadian Lakes. In the years 1867-8, the firm built and engined the Anchor Liner *India*, the first steamer on the North Atlantic route fitted with four-cylinder compound surface-condensing engines. About this period there was also constructed the first steam ferry boat for vehicular as well as passenger traffic at Govan. Indeed, the construction of ferry steamers of special form, made necessary by the conditions of local employment, afforded Mr. Brown many opportunities for the exercise of his ingenuity and engineering skill. Thus the employment of steam ferries on the Mersey, fitted with double ended screws, was introduced by him in the ferry steamer *Oxton* which he built for service between Liverpool and Birkenhead. More notable work still, however, was the designing of the four-screw double-ended elevating deck ferry steamers, which are now well-known features of cross-river communication in

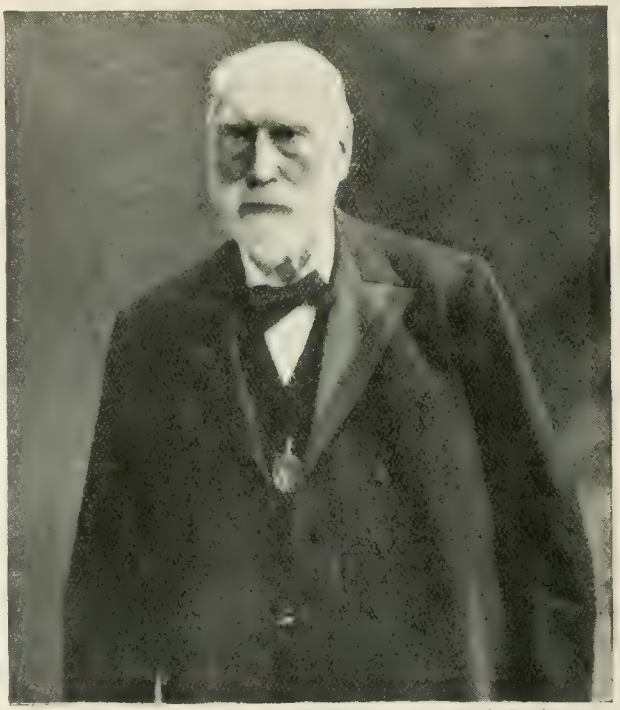


Photo by W. J. McIlwinck, Paisley.

The late Mr. Andrew Brown.

Glasgow. It may not be without interest to state that the Renfrew firm has embodied the principle of the elevating deck in the designs for steamers for the transport of railway trains—passengers and goods—across water-ways and channels, such as between Dover and Calais.

Lacking nothing of confidence in his own productions, Mr. Brown never avoided, nor delegated to others, any of the many risks which are indissolubly connected with the introduction of new features in marine and mechanical engineering. Perhaps no better illustration of this characteristic in him could be given than by citing the case of a diving bell which he constructed in 1861, to the order of the Clyde Trustees. This apparatus was constructed from Mr. Brown's own designs, and he it was who made the first descent to prove its absolute safety, so far as the occupant was concerned, and its efficiency for salvage purposes.

Married comparatively early in life, to a worthy helpmate who still survives him, although somewhat enfeebled, the deceased's family consists of four sons and four daughters, all of whom are married and survive and mourn their father's loss. Mr. Brown's early partner, Mr. William Simons—who belonged to an old and well-known Greenock family, and whose father started a shipbuilding business in that port so far back as 1810—retired from active participation in the Renfrew business about 1880 and died after a long period of leisure in October, 1902. In July, 1895, the business was converted into a private limited company, and in 1900, with a view to the adjustment of the private interests of Mr. Brown and his family, the company as at present constituted was incorporated. Mr. William and Mr. Walter Brown have been highly capable coadjutors of their father in the conduct

of affairs for a good many years, and in the practical departmental work they have been assisted by their two brothers, Mr. Andrew and Mr. James Brown.

Notwithstanding his exceptionally busy life, Mr. Andrew Brown found time—and had eminently the will—during his all but half-century residence in Renfrew, to devote attention and energy to furthering the interest of the community. Entering the Town Council in 1865, he served on it for the long period of thirty-five years, during fifteen of which he was Provost of the Royal Burgh. He had, in fact, the somewhat unique distinction of being elected, and serving as Provost for three consecutive terms, that is the nine years from 1891 to 1900. His successful piloting of the Renfrew Dock Scheme through parliament during 1896-1900 formed a fitting climax to his long labours in the interests of the community of Renfrew, and it has since led to a sound and highly promising future for the Burgh's interests. On the occasion of the celebration of their golden wedding, in October, 1899, Provost and Mrs. Brown were the recipients of numerous congratulations and tokens of esteem, including a public testimonial taking the form of portraits in oil; gold plate from the Council, etc., and it is of peculiarly melancholy interest to state that, so recently as the 9th April, a communication was received from the Town Clerk, intimating that at a meeting held the previous day, "the Town Council unanimously agreed to confer upon you the freedom of the Burgh of Renfrew, in recognition of the distinguished position you have taken in the engineering and shipbuilding world, of your long and faithful services in the Town Council, and as a mark of their appreciation of your high personal qualities, and the many kindnesses the community has received at your hands." Mr. Brown's remains were interred in Craigton Cemetery, some little distance from Renfrew, on the 9th May, the funeral being of a public character, very largely attended, and solemnised by impressive religious services and every token of mournful respect on the part of the residents of Renfrew and neighbourhood.

L. M. Bodin.—We regret to announce the death of Mr. Lauritz M. Bodin, manager and chief surveyor to Det Norske Veritas in Great Britain, which occurred at Harrogate. The deceased gentleman was stationed at the headquarters of the Det Norske Veritas, Sunderland, and lived at 19, Argyle Square. He was born at Sandefjord, Norway, in 1849. He came to Glasgow with the late Mr. Alex. Allan from Christiania, and served part of his career in engineering shops, and as a sea-going engineer. Mr. Bodin held a certificate as a civil engineer, and also a Board of Trade first-class engineer's certificate. In 1886, he was appointed engineer surveyor to, and twelve years later manager and chief surveyor of the Det Norske Veritas in Great Britain, and since his connection with it the Norwegian Veritas has arisen from an obscure position to its present important relationship with the shipbuilding and engineering industries of the country, having a large staff at the head office in Sunderland, as well as assistant surveyors of high standing in London, Liverpool, Cardiff, Hull and Glasgow. As a practical manifestation of his warm interest in the welfare of Norwegian sailors, he was instrumental in the erection of a reading-room at a cost of £700 for his countrymen at Tyne Dock in 1900. The Norwegian Sailors' Mission Society did not forget his work on their behalf, and made him a handsome present on the occasion of his silver wedding in 1905. His courtesy, sterling character and wide professional experience earned for him the esteem and respect of shipbuilders, and engineers, as also of the members of other classification societies with whom he was brought into contact. He was a member of the North-East Coast Institution of Engineers and Shipbuilders.

REVIEW.

(*See also page* 420.)

The Steam Engine and Other Heat Motors. By W. H. P. Creighton. London: Chapman & Hall. 1907.

THE author is a retired officer of the U.S.N. and professor of mechanics in a college on the other side of the Atlantic. He aims at clearness in the text book, and considers such books the basis of all technical instruction. With a view of simplicity he does not give any history of the steam engine, but endeavours to formulate fundamental principles, and he applies these, not only to steam engines, as the title demands, but also to gas engines and producers, refrigerating engines and turbines. The book opens with general definitions, but not in the manner we are usually accustomed to; for instance, work is explained rather by showing what it does than what it is, with several examples. The different forms of energy are made clear with their derivatives, and instructors on technical subjects here will pick up many useful hints in this connection. The laws of thermodynamics are clearly reasoned out, and with these preliminaries we are at once taken to steam engine and boiler details with representations of work and I.H.P., and efficiencies of engine and boiler. The subject is graphically shown by shaded areas. To measure the power the indicator is closely studied, and the method of taking diagrams. The figures themselves are analyzed in many varieties, and it is shown how to calibrate the apparatus. Closely associated with this branch is the slide valve, and we have its design basis put before us and the geometry of the Zenner diagrams, as well as that known as the Bilgram system. There are several examples to work out showing the relations that exist between lap, lead, throw of eccentric and angle of advance. The practical considerations that govern the subject are made prominent, for instance, the difference in lead between various sizes and kinds of engines and the dimensions of steam ports and pipes, thickness of cylinders, etc. The question of steam pipes and their design receives special attention, while in chapter V. the measurement of the effects of heat are explained, and how the energy is represented by areas leading up to a description of the well-known Carnot cycle. The measuring the effects of heat on water and steam is a branch that is very well treated here, and numerous examples are worked out which should prove valuable to engineering students. It is shown how to determine the dryness of steam by the use of the calorimeter. The measurement of heat losses is an interesting field for discussion found here, and also losses by condensation, leaky joints and in the cylinder itself. The thorny subject of entropy has a chapter devoted to it, and the author shows that, as with work represented by an area, so also is heat made up of two factors, one of which is absolute temperature or T, and the other, so difficult to describe, is what is known as entropy or ϕ, analogous to pressure in the P. V. formula. In putting the question into a diagram the author says absolute temperatures are represented by ordinates and variable entropy by variable abcissæ. The whole subject is more closely examined than we remember to have seen it elsewhere.

Condensers and air pumps make up another chapter, and the author draws upon ordinary and special examples for his explanations. Among the latter we notice Edwards' air pump and diagrams are shown of air pumps and feed pumps generally. Among small auxiliaries are included centrifugal pumps, injectors and feed heaters, while the chapter on multiple expansion engines is of the most interesting character; the two classes of engines noticed are tandem and cross compound, and it is shown how to combine the diagrams from the cylinders and where and when losses occur.

The control of engines is a subject specialized here, and includes governors, adjustable eccentrics, and valve gears. In the last Stephenson's link motion is fully described. For marine engineers the subject of testing is important, and here it is fully gone into, Another matter treated is that of super-heated steam and turbines. We have not only the engines themselves, but the theoretic action of the steam in its progress. A chapter is devoted to gas engines and producers, and it is possible to obtain a very clear idea of the principles involved. Boiling in a vacuum, as in sugar evaporation, is noticed here with its single and multiple effects, and refrigeration in its different stages with particulars with regard to the ammonia compression system, and the data concerned therewith complete a volume that will take rank with any others of the same class. The author is not only scientific, but he is practical at the same time in the sense that he knows what a designer wants and endeavours to supply the necessary ground work required. Though a professor there is nothing too purely professorial to be found here. The calculus is drawn upon freely, and a considerable education would be necessary to comprehend the whole of the author's dissertations, but these, though minute, keep always to the subject under discussion and afford information which should be most helpful to a designer, because his wants are interpreted, and he has the reasons why before him and not merely formulæ which he has to take for granted. We think therefore, the volume should be appreciated accordingly.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our own Correspondent.*)

THE Scottish steel makers, impelled by the steady advance in the cost of pig iron, have raised the price of manufactured steel 5s. per ton, and now quote for angles £7 10s., ship plates £7 17s. 6d., and boiler plates £8 12s. 6d. per ton, subject to the usual 5% discount for cash in one month. It is reported that along with the advance there has been a considerable amount of fresh business placed with the makers.

Reports in Clyde ship-building and steel-making circles credit no fewer than seven shipowning firms with being in the market for Tank Steamers. The demand for this class of vessel has been greatly stimulated by the relaxation of the Suez Canal regulations as to the passage of steamers carrying oil in bulk, conjoined with the great increase in the consumption of petrol for motoring purposes.

Messrs. William Beardmore & Co., Dalmuir, who have still on hand two of the four steamers they were commissioned last year to build for the Pacific Steam Navigation Company, received early in May a further order from the same company to build and engine a twin screw steamer for their South American trade. The vessel, which is to be named *Arooma*, will be 530 feet in length, 62 feet in beam, 40 feet 6 inches in depth, and of 11,000 tons gross. She will thus be the largest of the Pacific Line's fleet. The vessel is to be fitted with all the latest improvements, and cabins de luxe on the bridge and upper decks. She will have passenger accommodation for 250 first-class, 250 second-class, and 700 steerage.

The extreme meagreness of the naval work on hand, and in prospect, in Clyde establishments is brought more forcibly home to builders and artisans there by what at present obtains regarding similar work on the Tyne. Messrs. Sir William Armstrong, Whitworth & Co. have lately launched the cruiser *Invincible*, and the vacated berth is about to be occupied by the first of three heavy battleships ordered by the Brazilian Government. The *Invincible* is sister ship to the *Indomitable*, launched at Fairfield yard a month ago, and also of the *Inflexible*, the launch of which from Clydebank has been delayed for some short time on account of certain parts requiring replacement owing to slight defects having been discovered. In neither of the two Clyde yards, however, is their any new work to fill the places at the vacant berths.

At Messrs. Beardmore's yard, at Dalmuir, similar idleness in warship construction is to be noted. The *Agamemnon* left the stocks in June of last year, and her place is still vacant. Her engines, however, are coming on from Newcastle. The Fairfield Shipbuilding Company, it is true, has an order on hand for the machinery of a *Dreadnought* building in a Royal dockyard, and Clydebank has an order for the machinery for a dockyard cruiser of smaller dimensions.

The new Coventry Ordnance Works, which are now about completed at Scotstoun, are for the manufacture of gun mountings for warships, and are jointly owned by Messrs. Cammell, Laird & Co., Birkenhead; John Brown & Co., Clydebank; and the Fairfield Shipbuilding and Engineering Company, Govan. They cover an area of twenty acres, and include two fine workshops, each having a length of 675 feet, and a collective width of 134 feet, the height being 63 feet. In the larger bay there is to be an overhead traveller to carry a load of 100 tons, and others of from 60 tons capacity downward. The crane rail-level is 44 feet above the floor, so that the loads carried may be not only heavy, but of large bulk. In the same bay, but at a lower level, there are to be rails for a series of ten-ton travellers for the ordinary shop work. An unusual feature in this bay is that both crane runways are the same span, so that the lighter cranes may be lifted to the higher level, and worked there. Parallel with these shops is a gantry of corresponding length, *viz.*, 675 feet, with a span of 87 feet, and a height above the surface level of 50 feet. This gantry is for the accommodation of 100-ton and lighter cranes for the loading of gun-mountings. The whole of the constructional steelwork of these large shops, requiring the use of 2500 tons of steel, was completed within six months of the date of the placing of the order. Of this time sixteen weeks sufficed for the erection of the structure—a proof of the splendid organization and suitability of the manufacturing and erecting plant employed by the contractors, Sir William Arrol & Co. (Limited), Dalmarnock Works, Glasgow.

Messrs. Ferguson Bros., Port Glasgow, have received an order from the Crown Agent for the Colonies to build a twin-screw shallow-draught steamer for service in Nigeria. The vessel will be built under the supervision of Messrs Byles, Gray & Co., London.

Messrs. Murdoch & Murray, Port Glasgow, have received an order to build a twin-screw passenger steamer, which is intended for service on the river Amazon. Messrs. Ross and Duncan, Govan, will supply the machinery.

Messrs. William Chalmers & Co., Broomloan shipyard, Rutherglen, have recently booked an order for a 90-ton steel ocean-cruising yacht for an English gentleman. This vessel will be built under special survey and to Lloyd's highest class. This firm has also booked an order for a steel twin-screw cargo launch, 90 feet long, for the Amazon, and has recently supplied two steam ferries to the Argentine Government.

Messrs. Fleming & Ferguson, Paisley, have received an order from the Great Yarmouth Port and Haven Commissioners for a bucket dredger and four hopper barges, to be employed on improvements being carried out on the harbour there. About two weeks ago this well-known Paisley firm launched the last of the four 1400-ton hopper steamers, which, with a very powerful bucket dredger supplied some time ago, form the latest—as it is intended to be the most potent—contribution to the plant by which the Thames Conservancy Board are to aim at deepening the channel to suit modern shipping. In connection with the work, now proceeding on the Thames, it is of interest to know that at an early date a deputation of the Thames Conservancy, of about twelve in number, will visit Glasgow, Liverpool, Manchester and Southampton, the object being to gather information and impressions of the progress recently made and still proceeding at these places with harbour extension and river improvement.

At Glasgow the visitors are likely to be specially impressed with the work of maintenance which is constantly going on, and of improvement which at this time is proceeding more vigorously than ever. For the passage of the new Cunarder *Lusitania* from Clydebank to the sea, about the end of June, quite a number of the Clyde Trust dredgers are at present employed making a deep and wide channel. In the region of Erskine House, and of Douglas Castle, four of the most powerful dredgers are presently at work, and another, the Craigiehall, built by William Simons & Co., will shortly begin to operate also. Besides these, one of the Tilbury Dredging Company's dredgers is being employed by the Clyde Lighthouses Trust in deepening the waterway between Newark Castle and the Tail of the Bank. The Clyde Trust dredgers are making a continuous channel of 33 ft. to 34 ft. in depth at high water all along the North side of the river and well across the centre. At bends the deep waterway comes nearer the south side than the straight sections. The big Cunard liner will go down the north side, leaving the south side for ordinary traffic. Later the south side will also be dredged to the same depth as the north side.

That there is no such thing as finality in shipping development and dock equipment receives striking illustration—although concerned with details—from the fact that while the chorus of praise and satisfaction over the electrical appliances at the new Clydebank dosk are still being echoed, a discordant note reaches the Clyde Trust as to the uselessness of cranes fitted in connection with the Prince's Dock, whose formal opening only took place about ten years ago. Messrs. Donaldson Bros., who within recent years have entered vigorously into the Canadian shipping trade, point out to the body named that owing to the increased size of their steamers and the shortness of the 35 cwt. crane jibs at the dock last named, these are of little use to them, and they request that they be removed and replaced by double power 2½-ton cranes.

The Royal Commission on Canals and Waterways at present considering evidence as to the intrinsic value and possible development of the various canals throughout the Kingdom are to visit the Crinan Canal in June, and it is now believed that they will also include in their tour of purview the more northern waterway—the Caledonian Canal. While schemes have been put before the Commission for enlarging the Forth and Clyde Canal and the Crinan Canal, none of the bodies most intimately concerned in the Caledonian Canal have been prepared to spend money in bringing forward expert evidence to urge the claims for that waterway. The prospect of the Commissioners' visit of inspection, therefore, is all the more gratifying. As Naval squadrons come more to the North than hitherto, and are using

harbours which are near the canal, there is some reason to believe that the Commission will go very closely into its possible advantages from a strategical point of view.

Messrs. Gourlay Brothers & Co., Dundee, have received an order from Mr. Lars Krogius, Helsingfors, for a steamer of 15 knots speed, and to carry a large number of passengers. The vessel will be 350 ft. long, and will have cargo space for 1800 tons.

The Dundee Shipbuilding Company propose to substitute for steam engines in their yard a complete electrical installation, consisting of twenty-five motors, representing in the aggregate about 300 horse-power. The current will be used both for power and lighting purposes.

Messrs. Kelso & Coy., the well-known ship model-makers, whose specialities in the way of artistic models, made to the order of the builders of the actual vessels, have graced every International Exhibition held in this country and abroad for many years, have removed from Oxford Street, Glasgow, to new and enlarged premises at 1008, Pollokshaws Road, Glasgow, where even greater attention than formerly can be given to orders entrusted to them, and additional special plant has been provided to overtake even a greater variety of commissions The firm are shortly to despatch to the Mitsu Bitsu Shipbuilding Company, Japan, all the machinery and equipment for an experimental tank for testing the speed and resistance of ship models based on the tanks at Messrs. Denny's yard, Dumbarton Brown of Clydebank, and the similar tank at St Petersburg, for all of which Messrs. Kelso & Coy. made and supplied the equipment

THE TYNE.

(*From our Own Correspondent.*)

Shipbuilding.—The pontoon dock ordered some months ago from Messrs. Swan, Hunter & Wigham Richardson, for location at the port of Trinidad, has just been launched, the time occupied in constructive work from start to finish having been less than six months. It is expected that the structure will be fully equipped with pumping apparatus and ready to leave the Tyne for the voyage to Trinidad by the first week in August. It is not yet known whether the firm have an order for another pontoon dock to occupy the vacated berth at the Wallsend yard, but it is believed that they are in negotiation for a contract of this description, and are reserving the berth in the expectation of securing this additional work. The firm are said to have booked some important orders lately for vessels required for special services, and both their Wallsend and Low Walker yards are likely to be kept busy for the remainder of the year.

Messrs. Armstrong, Whitworth & Co. have secured an order for two large oil-carrying steamers, both of which are to be built at their Low Walker yard. At their Elswick establishment there is a good deal of work in hand, and negotiations for further orders of a more than ordinarily important kind are said to be in progress. The equipment with machinery, etc., of the warship *Invincible* has been entered upon, and will be pushed forward with all possible despatch.

Messrs. Hawthorn, Leslie & Co., are understood to have booked orders for two or three boats of superior type, and their large graving dock is occupied with a vessel undergoing an important repair. The accommodation afforded by this fine dock for vessels of a large class is known to be exceptional, and it is not surprising to learn that the future engagements arranged for are sufficient to ensure constant occupation for several months to come.

Messrs. Stephenson's yard still presents a good show of work, and their graving dock, which is still larger than the dock just referred to, being, indeed, the largest on the north-east coast, is also occupied and likely to be kept so for many weeks. In this case, also, it is understood that there are a good many vessels booked for future docking.

Messrs. Readhead's yard and the Northumberland Shipbuilding Company's yard continue busy, but at one or two other establishments signs of a falling off are noticeable. Ship repairing is, at the moment, very plentiful, and a large number of hands are engaged in this branch. Messrs. the Smith's Dock Company appear to have the most work in hand, but many of the other large repairing firms are well supplied with contracts.

Engineering.—The wages question in the engineering trade is still causing uneasiness in commercial circles, the opinion being widely held that a rupture between employers and employed in this important industry is imminent. So far as we can gauge the situation, we are inclined to believe that the fears of a strike are exaggerated, as the officials and members of the Engineers' Society are not likely to have forgotten the lesson they received ten years ago. This lesson will have taught them that when once the federated employers have decided upon a course of action, that course will be tenaciously held to, and they will understand that nothing can be got from the employers by the belligerent methods that at one time were so effective. The employers have already stated their inability to concede a wages advance, and since this announcement was made nothing has occurred to materially affect the position. We, therefore, assume that the employers will hold to their decision, and that the men will find it advisable to postpone their application for an advance in wages until trade begins to show some approach to a genuine improvement.

The Ordnance departments at the Elswick works are now busy, and overtime is being worked in most of the shops. In the steel making departments considerable activity is to be noted, and the same may be said respecting all the steel manufactories in the district. Messrs. Scott & Mountain's electrical works, Gateshead, are kept going briskly on contracts for pumping and ventilating installations in collieries, and they have achieved many successes in this branch of electrical work during the present year.

The various departments of Messrs. Clark, Chapman and Co.'s works, Gateshead, are kept fairly well empolyed, the demand for the firm's special accessories for steamship equipment being well maintained. In the steel boat department activity has been the rule for some time. At Messrs. Abbots' works the bar rolling mill is kept going steadily, and the iron foundry has still enough work to keep the hands employed on full time. The engine works at Shields are generally pretty well employed, and the Jarrow Forge is well supplied with work. The Felling Tool Works (Messrs. Noble & Lund's) are still quite busy, the demand for the specialities manufactured in the establishment being well maintained.

THE WEAR.

(*From our Own Correspondent.*)

Shipbuilding.—As in all the other great centres of shipbuilding and engineering, work has been temporarily suspended in this district this week through the recurrence of the Whitsuntide holidays. In commercial circles it is pretty generally felt that the holidays, at this time of the year, are something of a nuisance, and that all classes would be the better for their discontinuance. They are so solidly established, however, by old custom that there seems to be no possibility of doing away with them, although their abolition would undoubtedly be a benefit to the community. Messrs. Sir James Laing & Sons are said to have booked an order for an oil-carrying steamer, and they have also a number of barges to build, which will be sent out in sections to the River Plate. The naval repairing ship *Cyclops* is nearly ready for delivery to the representatives of the Admiralty, and the material for two Australian liners is beginning to be received. The firm have a vessel in the Cornhill Dock undergoing rather extensive repairs. Messrs. Doxford have booked more orders for turret steamers, and their output of tonnage is, if anything, greater than the output for the first half of last year. Messrs. Osborne, Graham & Co. have their berths fully occupied, but at some of the other yards above bridge berths are vacant. In two cases, berths have been vacant for some weeks past, and there are as yet no signs of anything to fill them. This appears to be a conclusive proof that orders are now very scarce and difficult to secure.

The state of business at Messrs. J. L. Thompson & Sons' continues active, and at Messrs. Blumer's yard appearances are satisfactory, all the berths being occupied with vessels in various stages of progress. The yards at the South Dock, including the repairing works of Messrs. Greenwell & Co., are kept going steadily, and at Messrs. Austin's business is brisk both in new work and in the repairing of vessels.

Engineering.—At the Scotia Engine Works (Messrs. Richardsons, Westgarth & Co.) a very powerful stationary riveting machine has just been installed, and has already proved itself to be a very effective aid in the construction of the exceptionally large boilers which the firm are now in course of building. The machine, which is the design of Messrs. Hugh Smith & Co., Possil Works, Glasgow, is actuated by hydraulic and electrical power in combination, and is capable of closing rivets up to one and a half inches in diameter. It also closes the joints, where the plates forming the boiler overlap, in a manner hitherto very difficult of attainment. The Scotia Works, it may be stated, have sufficient orders in hand to keep all departments fully going to at least the end of the present year. Business at the other marine engine works remains much the same as it has been for some weeks past, the general tendency being in the direction of a falling off. In the smaller works the area of employment has diminished, but the state of work in the foundries shows no appreciable change. In electrical works business is still fairly active.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

ON Saturday, May 4th, the Colonial Premiers made a flying visit to Manchester. There was a procession through the main thoroughfares to the Town Hall, where a sumptuous repast was provided, and the freedom of the city conferred upon the distinguished visitors; and then they were driven back to the station. They had not time to visit the Ship Canal Docks. General Botha was the hero of the day. The visit, short as it was, it is believed will have some future beneficial effect upon Manchester trade.

Steps are being taken to form in Manchester a divisional command of the Royal Naval Volunteers for service either afloat or ashore. Divisions already exist on the Mersey, the Clyde, London, Bristol, and Hythe. The movement is owing to Manchester's growing importance as a port. The Ship Canal Co. are supporting the scheme.

The Trafford Park Estates Company having taken over the Dwellings Co. altogether, the former have assured the tenants of the houses in the Colony that their dwellings will be improved, and are prepared to receive suggestions as to the best way to meet their wishes.

Messrs. Mather & Platt, engineers, of Salford, are building a gas engine of about 800 indicated horse-power for driving a cotton mill, in which the weight of the fly-rope-pulley is only 18 tons. This is about the weight required for a cross-compound steam engine fly-wheel, and less than would be required for an engine with a single crank. This small weight is sufficient because the engine has two cylinders acting on cranks at right angles, each cylinder working on the double-acting two-stroke cycle, and because of the relatively high-speed of the engine, which is about 70 per cent. higher than is usual in steam engines of a similar size. At present, gas engines are more liable to trouble than steam engines, and there is a difficulty in starting them which has not yet been got over. On the other hand, no steam boilers are required, although, of course, gas producers are needed.

The British Westinghouse Co., Trafford Park, are manufacturing two 5,000 K.W. 3-phase, 15 periods, 13 volts, 900 r.p.m. turbo-alterno generator units for the Italian State Railways. These generating sets will be installed in a power station for supplying 3-phase current for traction purposes to the Giovi line, near Genoa.

The new substance called "Coalite," about the manufacture of which so little is at present known, has been in exhibition use during the month in Manchester. It has also been tested in house fires and also at the Manchester Municipal School of Technology, under a water tube boiler. This boiler was tested to 160 lbs. pressure per square inch. So far the smokelessness of the substance seems to be assured.

The timber trade has been only moderate during the past month. The imports have been good, and the consumption steady, but prices are weaker, especially in pitch pine. Timber in stock at the Manchester Docks is of considerable quantity, variety and value.

The Lagos cotton crop this year is expected to amount to nearly 15,000 bales. Last year the total was only 6,000 bales.

The Isle of Man Steam Packet Co. have given an order to Messrs. Vickers, Sons & Maxim, of Barrow, for a new turbine steamer, to carry about 2,500 passengers, at a speed guaranteed of 24 knots per hour. She is to be completed by the summer of 1908, and will be the fastest channel steamer in the country. The distance between Liverpool and Douglas will be covered in three hours: it is seventy-five miles.

A strong side-light is thrown on the progress of the Manchester Ship Canal by the city's banking business. In the twelve years after the opening of the Canal, there was an increase in Manchester's banking business of £957,984,560, figures which are somewhat startling. During the twelve years, before 1894, the total was £1,788,792,774; during the twelve years ending 1906, the total was £2,746,777,334. In 1894, the total banking business was £161,146,846. In 1896, it had risen to £193,573,541.

After an existence of fifty-two years, the Manchester Steam Users Association claims that no boiler the soundness of which has been guaranteed by the Association's inspectors has exploded and that no life has been lost from any cause which the Association could have prevented. Last year, 8,586 examinations were made. It is significant that outside the ranks of the Association there were thirty-two explosions during the year, killing twelve persons and injuring thirty-three.

Traffic on the Ship Canal continues satisfactory. Large consignments of cotton and fruit have arrived during the month both from America and Egypt. An application is being considered by the Ship Canal Company from labourers employed at the docks who are claiming concessions for Sunday work.

The Mersey and Irwell Joint Committee are continuing their efforts to free these rivers from pollution, but it is a slow and weary process and one is surprised that the advance made is so small. The latest report of the chief inspector of the committee shows, strange to say, that the worst pollutors are still the same authorities, *viz.*: The Corporations of Manchester, Salford, Macclesfield and Bolton.

Pig iron during the month has become scarcer and dearer. The unexpected demand for raw metal from America and the European Continents has practically cleared out the deposits in the public stores. Home trade demands have remained steady. Smelters are having a busy time, and sales have been on a large scale. The rise in prices has been continuous. The wonder is when it is going to stop. Manufactured iron has been affected to the disadvantage of the buyer. The high prices of copper, tin, lead, and spelter have seriously affected brass founders. Efforts are being made to find a substitute for copper, but nothing at present seems likely to be of service in that respect, except aluminium. Prices of pig iron and manufactured iron may have varied since Whit week, but on the Manchester Exchange during the holiday period average quotations were as follows: Scotch metal, delivered Manchester docks, Eglinton, 75s.; Dalmellington, 75s.; Glengarnock, 77s.; Gartsherne, 78s.; 2s. 3d. less per ton if delivered at Heysham or Fleetwood and 1s. per ton less if landed at Preston. G.M.B. Middlesbrough, 70s. 6d.; Derbyshire, 66s.; Staffordshire, 65s. 6d.; Lincolnshire, No. 3, 67s.; ditto, foundry, 65s. 6d.; ditto, forge, 63s., delivered equal to Manchester; Hematites (West Coast) and ditto (East Coast), 81s. per ton. Scrap iron, 65s. per ton. Steel firm and a good business doing. Billets have been scarce, but some 40,000 pieces have been delivered at our docks during the last few days, some from America and some from the Continent, with a considerable quantity of spelter. Manufactured iron: Bars (iron) £7 15s. to £8; steel rounds and squares, £8 to £8 5s.; flats, £7 5s. to £7 7s. 6d. angles, £7 2s. 6d. to £7 5s.; tees, £7 10s. to £7 12s. 6d.; joists, £7 5s.; channels, £7 15s.; iron hoops, £8 7s. 6d.; steel boiler plates, £8 12s. 6d.; ditto, ship plates, £7 15s.

The coal trade of the County Palatine is enjoying a state of great prosperity. It is many years since the present record of prices was at all equalled. The exportation of coal has been considerable and the large and continuous increase in the number of cotton mills and weaving sheds, to which may be added an enlarged output of textile and other machinery, has created an enormous demand for boiler fuel. Although the requirements of householders has shown during the last two months a steady falling off, no reduction in price, but rather the contrary, has taken place. We never

remember house coal in Lancashire being so dear, better qualities realizing an average of £1 per ton. Most of the pits were closed during Whit week, but the loss in the consequent non-working was fully compensated for by the corresponding stoppages of the cotton and engineering trades. Average prices at the pit's mouth in the Manchester district are as follows: Best house qualities, 14s. 6d. to 15s. 6d.; secondary, 13s. 6d. to 14s.; common, 10s. 6d. to 13s; burgy, 9s. 8d. to 10s. 4d.; best slack, 8s. 10d. to 9s. 6d.; medium, 7s. 10d. to 8s. 6d.; lower qualities, 7s. 4d. to 7s. 9d.; coal for shipping, 12s. 6d. to 13s. 6d.; f.o.b. at Garston; furness coke, 17s. to 24s. per ton.

THAMES.

(From our Own Correspondent.)

THE question of the future of the Port of London has been advanced a further stage by the withdrawal of the London Port and Docks Bill promoted by the London and India Dock Company after intimation from the Board of Trade that this department could not accept the measure as it stood, and that the Government would deal with the whole question next session on the lines of a public port authority. The reason for the action given by the Government is that by the passing of such a measure as that now rejected a toll would be levied on all goods coming into the Thames, half the returns from which would go to the companies. Finally, the matter was shelved for the present in the House of Commons by being talked out.

The new London County Council has decided to proceed with the construction of the proposed County Hall on the south bank of the river contiguous to Westminster Bridge at a cost of £1,700,000, a project left to them as a legacy by their predecessors, and trial borings are to commence at once on the site of the new buildings. Even then it will be some years before the structure as contemplated will be finished, the year 1916 being mentioned as the date of completion, though partial occupation will take place some time previously. If the council has proved its reasons for existence it would seem only correct for this body to be located in a home of its own instead of paying rent, and the new buildings should add to the amenities of the river at the position selected, one which is already not unprovided with architectural beauties.

With the season of the year now beginning the Council's huge fiasco from a financial point of view of owning their own steamboats once more makes its appearance on the river. The boats are to be seen in all their new colours, but the absence of passengers is as conspicuous as ever. Meanwhile, as was to be anticipated disputes have arisen over the rates of pay of the men which have been settled by following an agreement arrived at by arbitration. There are indications that the present season may be the last in which public money will be employed for what has been described as a purely pleasure service and for in no way furthering the trade of the port.

Messrs. Yarrow & Co. are reported to have booked orders for ten torpedo boat destroyers of 240 feet length for the Brazilian Government. The vessels will have a normal tonnage of 650 tons and a speed of twenty-eight knots. They are thus somewhat larger than the river class recently supplied to the British Government. The new contract is to be completed during the next two years, and the firms tendering are said to have been Beardmore & Co., Thorneycroft & Co., and Shichau. Messrs. Thorneycroft have just delivered the *Greenfly*, which will be employed at Sheerness. She is fitted with Parsons' turbines and Thorneycroft water-tube boilers to drive her at a speed of twenty-six knots.

There is a plethora of meetings of public companies at about this time of the year, and amongst them shipping and cognate industries take a prominent place. The report of the P. and O. Co. says it has secured the Imperial contract advertised by the Post Office for carrying the Eastern and Australian mails for a period of seven years, but there is to be an acceleration of speed and a diminution in the subsidy. As the company has no steamship on the stocks at present the new contract may, perhaps, mean an addition to the fleet, which stands at 382,888 tons already. The freight war with the Hansa Company, of Bremen, has depressed freights considerably, but as this is now ended an improvement may not unreasonably be looked for. The Australian business generally has improved except for refrigerated produce. A great advantage this company possesses is that it does not deal solely with one market.

The Orient S. N. Co. have held their seventh general meeting, and the report says that after a lapse of five years a dividend has been earned from the year's operations. The returns thus show a balance of £17,950 to the good, from which a 5 per cent. is payable on the deferred shares, leaving £1985 to be carried forward after providing for the preferred dividend. The company will now have to work on rather different lines, the report says, as they will be without a Government subsidy in the future. The Shaw Savill and Albion Co. report a balance of £22,457, from which an interim dividend has been paid and upon both classes of shares a balance dividend of 5 per cent. is to be paid, carrying forward £3009. The Union Castle Co. pay a total of 10s. per £10 share for the year, and also a bonus of 2s. 6d. per share on the ordinary shares. The Royal Mail Steamship Co. pay a dividend of 5 per cent. per annum on the preferred stock, and it is expected there will be a dividend on the ordinary stock at the end of the present year.

J. I. Thorneycroft & Co. have presented their annual report, which is not so favourable as for the previous year. The removal of the works to Southampton has been a charge on the company from which a benefit will be likely to accrue in the future, and there is a loss on the motor bus business. In the marine department the introduction of turbines and oil fuel has not been favourable to the company in the way of prices. With a trading profit of £25,329, however, and a sum of £12,772 allowed for depreciation, the debenture interest is paid for and £1068 is carried forward.

At the final meeting of the Colonial Merchant Shipping Conference it was agreed that the Australian and New Zealand laws should not be more onerous on shipping registered in the United Kingdom than on that of any foreign country, and the same two governments are not to differentiate to the disadvantage of oversea vessels engaged in the coasting trade of these two countries. The colonies were asked also to conform to the Imperial Merchant Shipping Acts as far as possible.

Though a certain number of 12-in. guns have been placed on order at Woolwich Arsenal for the new *Dreadnoughts*, discharges are still taking place, and a monster demonstration has been held at Trafalgar Square by the men, at which resolutions were passed.

The purification of the river is an important matter, and the Port Sanitary Authority of the Corporation convened a meeting of those interested to consider the present position. Representatives were present from the Thames and the Medway Conservancy, the Fishmongers' Co., the City of Rochester, the Kent and Essex County Councils, the Milton Creek Conservators, the Kent and Essex Sea Fisheries and the Oyster Merchants' and Planters' Association. The Port Sanitary Authority exercises a jurisdiction from Teddington to the Isle of Sheppey, a distance of sixty miles. It was explained that Southend, Sheerness and Whitstable discharge crude sewage into the sea. The same authority being the market authority know the danger to fish supply from any impurity of the estuary. In the end a resolution was passed asking the Local Government Board to initiate steps to deal with the subject, and in the meantime controlling bodies should be advised to adopt a system of sewage purification.

A general court of the governors of the Marine Society has been held, from the report at which it shows that there are 200 boys on the *Warspite* and 100 on the *Port Jackson*, the training ship which went to Australia and has just returned to the Thames after a successful trip.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow.—A stronger tone characterizes the shipbuilding trade of this district, and there has been a distinct advance during the month in the activity at local yards, and in the conditions which make for general briskness. Local builders

are indeed well off for orders, but they are open for large work, and are likely to get it. Their works are especially fitted for the building of heavy warships, and they are likely to be busy in this department before long. They have at present only one large ship on the stocks, and they are in a position to lay down at least a dozen large vessels at one time. This is a strong point in favour of any shipbuilding company, as while heavy work is maturing smaller tonnage can be undertaken and be got rid of before the more important contracts have reached the point of requiring berth space. Recently Messrs. Vickers, Sons & Maxim have adopted the policy of undertaking commercial tonnage during the times when warship orders are not plentiful, as by this means they not only are able to keep their staff in employ, but they are in a position to show to the shipbuilding world their aptitude for the building of commercial tonnage of highest class which is from time to time required. They could not, of course, build vessels of the tramp order, as the men employed and the material used would prevent them from realizing a profit, but they can build the highest class of mercantile marine, and dovetail their orders in with the special high class of warship construction for which the yard has been specially equipped. The business in hand at the moment embraces a Brazilian cruiser, three London and North-Western steamers, two steamers for the Furness Railway Company, a Mexican transport steamer, an Indian survey steamer, and a turbine steamer for the Isle of Man Steam Packet Company. The latter will be the fastest channel steamer afloat. She will steam twenty-four knots per hour, and will probably steam a knot over. She represents the maximum any cross-channel steamer can hope to attain, as any higher speed would be an impossibility in the Mersey, where the wash is so great as to necessitate the slowing of engines between the Bar lightship and the Princes landing stage, but of course in the open sea between the Bar lightship and Douglas a fast steamer is of service. This vessel will carry no less than 2500 passengers, and will, of course, be driven by turbine engines. Barrow builders have had much experience in the building of turbines, the turbines of the *Dreadnought* having been built at Barrow, and special machinery has been laid down for this class of work. The new Manx steamer has to be on the service next Whitsuntide, and already many of the initial features of her construction are in progress.

The great feature of the month has been the visit of Prince Fushimi with reference to the placing of an order for a Japanese *Dreadnought* in this country. He visited the yards at Elswick and at Clydebank before coming to Barrow, where the *Mikasa* and the *Katori*, units in the Japanese Navy, were built. He was conducted by the directors through the works, and was much interested in seeing not only the building of a modern leviathan for Brazil, but in the construction of British submarines, which have only up to now been launched from the Barrow yard, and also in the construction of merchant steamers. One of the features in the latter department was the lifting of the bow of a merchantman, in its entirety from the yard, and the placing of the same by means of cantilever cranes in the place it will ultimately occupy in the ship. This is a novelty, and it is probably the first time it has been done in the history of shipbuilding. It marks a more economic method than has hitherto been adopted. He afterwards went through the immense engineering shops of the firm, and was very much struck, not only with the size and capacity of the place, but with the various stages of the important work in progress as well in the engineering as in the ordnance branches. Several 10-in. and 12-in. guns and others of smaller calibre were trained and elevated as though they were aboard ship. Several sets of marine engines were also viewed, and some interest was also taken in a visit to the Russian cruiser *Rurik*, special permission having been graciously accorded to the royal visitor to inspect this vessel of their late enemy. Afterwards the Prince was much interested in the manœuvres of one of the British submarines of the "C" class in the Devonshire Dock at Barrow, which was in charge of a special party from the Admiralty. This is one of the directions in which the Japanese will doubtless proceed in the strengthening of their navy, and the Prince was very inquisitive about the performances of these sub-aqueous vessels with their known destructive qualities. The Prince was the guest of Vickers, Sons & Maxim at Furness Abbey Hotel, and on the following day left for Liverpool.

The Brazilian battleship building at Barrow is to be named *S. Paulo*, and the Indian survey steamer is to receive the name of *Investigator*. The order for the Mexican transport steamer is now affirmed. There is a growing activity in the Vickers' shipbuilding yard, and it seems probable this department will soon be as busy as that of engineering. Boilermakers are not so busy, but iron founders are well employed, and the steel foundries are full of work. Gun-mountings are in full demand, and a large number of orders are in hand.

West Cumberland.—There is a steady and strong tone in the shipbuilding trade of West Cumberland, and there seems to be a greater regularity of business than in the general run of shipbuilding centres in the country. Only small tonnage is built, but there is plenty of it, and as one ship is launched another takes its place. At present the builders at Workington and Maryport are very well off for orders.

Shipbuilding Material.—A better demand has arisen for shipbuilding material, but it is mainly for forward delivery. Makers are quoting £7 12s. 6d. for heavy plates net cash, and in a few weeks' time it is expected that the mills now on half-time will be fully employed.

Hematites.—The hematite trade is much busier, and prices have advanced to 81s. per ton net cash. Stocks are down about 20,000 tons.

Shipping.—The shipping trade is busy, and the exports of iron and steel show an increase of over 50,000 tons on the corresponding period of last year.

SOUTHAMPTON.

(From our Own Correspondent.)

Messrs. Day, Summers & Co., of the Northam Iron Works have just completed an extensive repair job on the Royal Mail Steam Packet Co.'s s.s. *Magdalena*. The vessel was in dry dock here for about ten weeks for the purpose of effecting these repairs. About sixty-four plates were doubled and twenty-five renewed, besides joggled plates over seams, and shoe pieces along the keel; also the floors, intercostals, keelsons, etc., were renewed or repaired, as found necessary. Messrs. Day, Summers & Co. also supplied two new funnels and a new furnace.

The Royal Mail Co.'s shore staff were busy with the engine room, and fitted two new Gwynne's centrifugal circulating pumps; replacing the original reciprocating pumps.

The *Magdalena* was built eighteen years ago by Messrs. Napier & Sons, of Glasgow, and has been on the R.M.S.P. Co.'s Brazil and River Plate Service from this port. She is a vessel of 5,370 reg. tons. Owing to the shallow water at the River Plate Bar, steamers of this size are on the muddy bottom for a considerable distance and in course of time this friction causes wasting of the bottom flue strakes.

Messrs. Day, Summers & Co. have been established since 1834 and have large up-to-date premises at Northam, capable of dealing with all kinds of marine repair work.

The s.s. Newstead, of Newcastle, is at present lying in the Inner Dock with severe damage to the bottom plating, sustained by grounding. To effect repairs it will mean practically a new bottom. The vessel was dry docked here some time ago for purposes of examination, but whether the repairs will be effected here or away is not yet decided. We learn that the cost of this repair may be about £15,000.

White Star Line and Southampton.—The London and South-Western Railway Docks Co. are constructing a large travelling gantry, and stairways at side, and through the roof of the sheds, to enable passengers to land readily from the passenger decks of these vessels, which are of such large freeboard.

Superintendent Engineer, Red Star Line. We understand that Mr. Carnegie, assistant superintendent engineer of the American Line, now in America inspecting the fitting of new boilers to the *St. Paul*, has been appointed resident superintendent engineer of the Red Star Line at Antwerp.

A Smart Repair Job.—The Royal Mail Steam Packet Co.'s *Severn*, when dry docked here on the 4th inst., was found to have a fractured rudder, the defect being close under the coupling. A new rudder was immediately ordered from Messrs. the Darlington Forge Co. Their representative

visited Southampton and took particulars for a single plate type rudder to replace the defective one, which was of the box pattern. The new rudder, complete with shank, and brass-lined pintles, weighing about 6½ tons, was received in Southampton Docks at 10 a.m. on the 12th inst. The time taken to make and deliver, including railway transport, being only seven days. The rudder was fitted afloat, and the *Severn* proceeded on her voyage after a detention of seven days.

From the above it will be seen that the Darlington Forge Co. are in a very good position to deal with this class of work, where delivery is of the utmost importance.

The latest addition to the London and South-Western Railway Co.'s fleet, the steam tender *Atalanta*, arrived in the docks on the 23rd ult. She is a powerful-looking vessel and is equipped with gear for towing purposes, besides being comfortably fitted for passengers. The vessel will be stationed at Plymouth to act as tender on the large liners calling at that port. The *Atalanta* was built and engined by Messrs. Gourlay Bros., of Dundee, who lately built the passenger steamer *Princess Ena* and the two cargo steamers *Ada* and *Bertha* for this company.

BELFAST.

(*From our Own Correspondent.*)

MESSRS. Harland & Wolff have received an order for a Dominion liner of 14,000 tons. The vessel will be named the *Albany*, and is to be similar to the one at present building at the Queen's Island, which will be named *Alberta*. Two notable vessels have left the Queen's Island since last month's Notes were penned. The first was the new White Star liner *Adriatic*, and the second the Hamburg-American liner *President Lincoln*. The former vessel has already made her maiden voyage, and that with complete success, the passengers being unanimous in their praise of the vessel's behaviour, and of the innumerable comforts provided for them. It is not necessary to give here a description of this magnificent steamer, which is the perfect embodiment of all that is luxurious. The *President Lincoln*, which was referred to in last month's Notes, has a length of 616 feet; beam 68 feet 6 inch; depth 45 feet; and gross tonnage about 18,500. She presents a somewhat curious appearance in the matter of rig, being fitted with six short pole masts. In addition to large cargo capacity the passenger accommodation is very extensive, provision being made for between 300 and 400 first-class, 125 second-class, 1000 third-class, and 2300 fourth-class passengers. The propelling machinery consists of two sets of specially balanced quadruple-expansion engines. Good progress is being made with the building of the forward portion of the recently wrecked White Star liner *Suevic*. This, when completed, will be taken round to Southampton where the after-length at present lies. Messrs. Harland & Wolff have a very fine exhibit of models in the newly opened International Exhibition at Dublin, including full models of the *Kenilworth Castle, Marmora, Philadelphia*, and *Massachusetts*. There are also half models of the first and second *Oceanics, Majestic, Cufic, Celtic*, and *Cevic*. A specially interesting model is that of the *Kitty of Coleraine*, which was the smallest steamer built at the Queen's Island. She was built in 1863, the registered tonnage being 24·35 tons, and the horse-power 10. In addition to these models, there are exact representations of suites of rooms in the most up-to-date White Star, Royal Mail, and other lines. The steel s.s. *Elmina*, 1764 tons gross, built and engined by Messrs. Harland & Wolff in 1885, and owned by Messrs. Elder, Dempster & Co., has been sold to Dutch buyers for about £3500.

On the 30th of April, Messrs. Workman, Clark & Co. launched from their North Yard the second of the batch of steamers which they have in hand for the Lloyd Brazileiro. The vessel, which was named *Para* by Mrs. Frank Workman on behalf of Madame Francisca C. Buarque de Macedo, of Rio Janeiro, has a length of 354 feet, and gross tonnage of over 3500 tons. Accommodation has been arranged for 170 first-class, 20 second-class, and 300 third-class passengers. The propelling machinery consists of two sets of triple-expansion engines supplied with steam by three boilers working under Howden's forced draught system. The Shaw, Savill & Albion Co. have placed with Messrs. Workman, Clark & Co. an order for the construction of a steamer similar to the *Matatua*, built by them for the same company in 1904. The *Matatua* is a vessel of 6488 gross tonnage.

There is at present a strike of dockers in Belfast. The men concerned in it are those who were engaged in the discharging and loading of the Belfast Steamship Company's vessels. Those who are members of the labourers' union demand that the men who are not, should become members, and the majority of the latter declined to accede to the demand. The company, backing up these non-union men, have had a number of labourers sent over from Liverpool by the Shipping Federation, the firm's steamer *Caloric* being used as a floating lodging house, thus keeping the imported workmen beyond reach of the disaffected men. The work of discharging and loading is being carried out under police protection, notwithstanding which there have been several somewhat ugly scenes, the military having on one occasion to be called out. The strike is being engineered by a representative of the Union, and hopes are entertained that the men, some of whom appear inclined to return to work, will shortly see the folly of allowing themselves to be led by the nose by a paid agitator.

JUNIOR ENGINEERS.

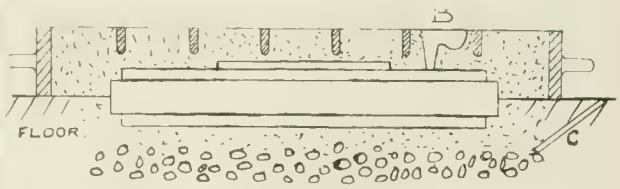
IX.*

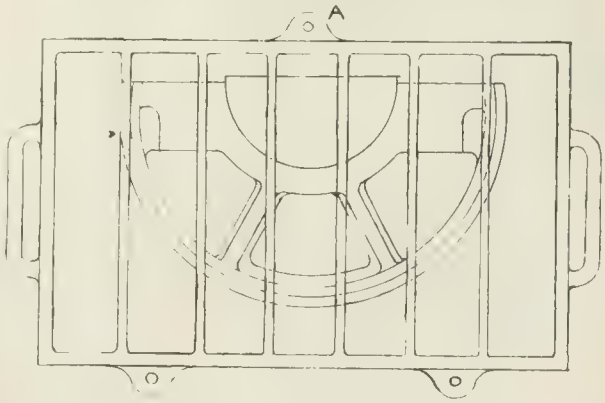
By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Moulding *(continued)*.

OPEN sand moulding gives the roughest castings and hence this method is only employed when roughness of surface is a desirable quality, as in core grids and moulding flasks; a level bed of sand is prepared and made sufficiently firm, so that it will take an impression when the pattern is pressed down into it, or beaten in if necessary;





the mould is thus prepared, no blacking is applied and the metal being left free on the upper surface, the casting produced is only fit for the purposes mentioned.

The moulding flasks or boxes are, in general, rectangular in shape, and to avoid the needless ramming in of sand when small or circular jobs are being moulded, where special boxes are not kept, the corners of the flask are filled in with iron

* For Articles I. to VIII., see last eight issues.

corner pieces. Cross bars or traverses are cast on the box, to bind the sand and to prevent it from falling away; it frequently happens that a bar obstructs a projection of the pattern, and although the first cost is greater, it is advisable to have a few boxes with the bars cast separately and bolted on, so that one can be removed without having to break it. Snugs are cast on the sides, as at A, and bored to suit the fixing pins. Handles at either end are also provided for lifting the boxes and made in the form of swivels for the larger sizes for ease in turning the flask over.

One or more of these boxes may be employed, according to the number of partings required by the job, or, as with swept moulds, no box is used, the mould being erected on a flat plate.

When a pattern can be moulded with one parting only and the casting is not of an intricate nature, the method adopted is termed bedding-down, one half of the pattern being moulded on the floor in a somewhat similar fashion to the open sand mould.

An eccentric provides a simple case of a bedded-down mould, the ribs between the nave and the rim and the shape of the rim itself require that a parting be made. A core box is made for the shaft bore, this being formed of two semi-circular pieces fixed to a base, allowing sufficient length of core to suit the prints, one on the face and another on the joint.

A loose bedding of pebbles or similar material is made in the floor, from which vent tubes are led to the surface, as at C: over this bedding, a layer of coarse sand is riddled and then a top layer of facing sand, and the pattern beaten into this to form the lower half of the mould. The cope, an ordinary moulding flask, is then placed over the pattern and a layer of facing sand riddled in, the box is then rammed up with the coarser sand, a tapered wooden plug being rammed in with the sand and when the mould is completed, this plug is withdrawn and the basin B scooped out, as shown, for pouring in the metal.

To ensure the cope retaining its position, stakes are driven into the floor round its sides, so that when lifted off and the pattern removed, it can be replaced in the same position. The core having been placed in the mould and the cope put on, a sufficient number of weights are laid upon the cope to resist the upward pressure of the liquid metal, the mould being then ready for pouring. The sand is rammed into the cope with a ramming iron and made sufficiently close to bind the whole together, the vent wire being passed down through the sand and withdrawn, to allow of the escape of the gases formed.

REVIEWS.

(*See also page* 413.)

Practical Mathematics for Young Engineers. By F. Hovenden. Glasgow: Jas. Munro & Co.

THE author opens by saying it may be doubted if there is a want for a book of this kind, but claims that his way of treating the subject is novel, in so far that he directs what he puts forward to draughtsmen and mechanics. In the leading chapter we feel almost taken to school again, so simple is the instruction in elementary arithmetic, but as we go on the weights and strengths of materials are introduced and particulars as regards fluids, which must tend to familiarise the student with articles in daily use in practical work. With the simple rule in mensuration exemplified, the author then proceeds with equations, beginning with the formula for horse power and following on with strengths of riveted jointing, the rule for nominal horse power, and the I.H.P. to drive a vessel at a given speed. With mensuration we have the areas of figures leading up to the well-known Simpson's rule for these calculations. It is also shown how to find the weights of various quantities both solid and fluid, and in different shapes of enclosure.

Section III. opens with simple mechanical principles, such as gravity, stable and unstable equilibrium. The parallelogram of forces is then used to show how the pressures on steam engine guides are obtained and the stresses on roofs. The principles of simple mechanics begin with levers, beams, inclined plane and continue with the screw, the wheel and axle, the winch, the worm, wheel screw and pulleys. Though simply the laws of motion are very clearly explained with the formulæ governing them. Examples such as centrifugal force are introduced at this point, followed by the conical and reciprocating pendulums and the engine governor. It is shown what kinetic energy is, and mention is also made of the rules that concern hydraulic pressures. Though in simple form we think this little work is likely to prove useful to students, and should be of assistance both in examinations and for finding a permanent place on a marine engineer's book shelf.

Kelly's Directory of the Merchants, Manufacturers and Shippers of the World for 1907.

THE 21st edition makes its appearance, and the first or colonial and foreign section contains a concise statistical account of each country, with its ports and principal towns and classified lists of merchants, brokers, shipping agents buyers and manufacturers of goods exported. The subdivisions into countries being arranged alphabetically according to continents, makes it possible to single out readily any spot on the surface of the globe and learn all about it. The second, or home division, contains the names and addresses of the manufacturers of the United Kingdom, and carefully arranged lists of exporters and importers, showing not only the countries with which they carry on business, but the goods they deal in. This section is arranged in the order of London first, followed by England, Scotland, Wales and Ireland. We have nothing but praise for the industry and enterprise which essays to publish a volume of such capacity, embracing as it does such a diverse fund of information collected from so vast an area.

Taschenbuch fur See maschinisten. By Messrs. Ludwig and Linder. Munchen: R. Oldenbourg, 1907.

THIS book is written by engineers for engineers, and opens with a table of squares, tubes and natural logarithms up to 1000. The simple principles of mechanics are illustrated, with the rules governing them. Dynamics and hydrostatics are treated in the same way, rivetting, strengths of beam, torsion and the power of springs. Engine design is closely gone into. No detail seems too small to be noticed, and valve motions receive great attention, with ports and starting gear all clearly delineated. Stern shafts are another detail found, showing how the propeller boss is fixed with the plane of the screw itself, and how it is struck. Condensers are treated carefully, also crank fittings. Cross head sides and glands are shown in detail. Turbines are dealt with mathematically, as also their arrangement on the vessel. There is nothing new here. It is rather the precise way everything is done. Indicator diagrams and the combination for different cylinders are shown, and also the strains on the columns with the engines working. Ordinary marine boilers with forced draught arrangements commence this section, followed by various water tube types, which we need not enumerate, as they are so well known. Pumps and fittings are elaborately described with the engines driving them, and we notice the duplex and centrifugal types with various forms of injector. The subject of refrigeration is noticed, and the question of steering gear explained with Brown's telemotor. Anyone wishing to understand electricity will find here the matter very well explained, and in a way that is most commendable. Measuring instruments, motors, accumulators, nothing is wanting, yet in succinct form. Under the chapter on instruments we find pressure gauges and indicators, and another is devoted to naval architecture and stability, with the question of water ballast, while again we have nautical instruments comprising the compass, the log, buoys and signals. The remainder of the book is taken up with rules for those in charge of ships. We have noticed the main headings of a book of handy size which must commend itself to engineers interested in marine work by reason of its clearness and the well-executed designs of the numerous details.

The Institution of Civil Engineers.—The fourth Engineering Conference will be held at The Institution on the 19th, 20th and 21st June; and the fifteenth "James Forrest" Lecture will be delivered by Dr. Francis Elgar, F.R.S., on Tuesday, the 18th June, at nine p.m., the subject being "Unsolved Problems in the Design and Propulsion of Ships." A detailed programme of the meetings of the Conference and the Visits to Works is in course of preparation, and will be issued early in June.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Herring Drifters.—There have just been launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, eight handsomely modelled steel screw drifters built to the order of Messrs. The London and Peterhead Steam Fishing Co., Ltd., of Peterhead, their principal dimensions being 84 ft. by 18 ft. 3 in. by 9 ft. 3 in. moulded, and the vessels will be fitted up in the latest style with all the most up-to-date improvements for herring fishing. Five of them will be fitted with compound engines 11 in., 24 in. by 16 in. with boiler 9 ft. 6 in. by 9 ft., 140 lbs. pressure, by Messrs. The Vauxhall & West Hydraulic Engineering Co., Ltd., of Luton, Beds., and three with similar engines by Messrs. Crabtree and Co., Ltd., of Great Yarmouth. As the vessels left the ways they were gracefully christened *City of London* by Mrs T. Appleton, of Hessle; *City of Edinburgh* by Mrs. H. Newton, of Hull; *City of Hull* by Mrs. Morton, of Wakefield; *City of Perth* by Mrs. McDonald, of London; *City of Liverpool* by Miss Horsey, of London; *City of Glasgow* by Mrs. Blackmore, of Wakefield; *City of Belfast* by Mrs. A. Appleton, of Selby; *City of Aberdeen* by Miss Hilkin, of London. The vessels have been built under the superintendence of J. L. Richardson, Esq., of Hull, and will be managed by Provost Leask, Esq., of Peterhead, who is one of the directors of the company. Amongst those present at the launches were Mr. T. Appleton, of Hessle, chairman of the company, Provost Leask, Mr. Hilkin, of London (directors of the company), Mr. Richardson, chief Board of Trade surveyor, Hull, Mr. Parnell, Board of Trade surveyor, Hull, Mr. J. L. Richardson, Captain David Buchan and Captain Robert Bruce, who are to command the first two vessels, and other friends. The above eight vessels have all been launched within about three months of the date of receiving the order.

Alu-Mendi.—On April 29th Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length, 285 ft.; breadth, 41 ft. 9 in.; depth, 18 ft. The vessel will be classed 100 A1 at Lloyd's, having main and quarter decks, break poop, bridge and top gallant forecastle; accommodation for captain and officers in poop, engineers in houses on bridge deck, crew in the forecastle. The vessel has double bottom for water ballast on the cellular principle, and in after peak. She will be fully equipped with an up-to-date outfit, including quick warping steam windlass, stockless anchors, steam steering gear amidships, and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete, and include four steam winches, steam being supplied by a large donkey boiler. The engines will be of the triple expansion type by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, of about 950 I.H.P., having two steel boilers 13 ft. by 10 ft., 180 lbs. steam pressure. The vessel has been built to the order of Messrs. Sota y Aznar, Bilbao, and the christening ceremony was gracefully performed by Mrs. Leonard Ropner, of Eaglescliffe R.S.O., who gave the vessel the name of *Alu-Mendi*.

Ellen.—On April 29th Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough, the steamer *Ellen*, built with cantilever frames on Harroway and Dixon's, John Priestman's and Livingston & Sanderson's patents to the order of Herr P. A. Gron, of Sandefjord, Norway. She is being built to highest class at Norske Veritas, her leading dimensions being 372 ft. 2 in. by 52 ft. by 28 ft. 4 in. moulded, and she will carry a deadweight cargo of about 7200 tons, on 23 ft. draught with four exceptionally large hatchways 36 ft. long and 30 ft. wide and perfectly self-trimming and unobstructed holds. The vessel will be equipped with nine powerful steam winches, steam windlass, two masts, eight derricks, hand and steam steering gear, and will have six water-tight bulkheads, four holds, three boats and all the latest and most modern appliances for the rapid handling of cargo; in addition to this the vessel will carry an unusually large quantity of water ballast located under the deck in top side tanks, as well as in the double bottom and fore and aft peaks. She will be fitted with engines placed aft by the North-Eastern Marine Engineering Co., Limited, Sunderland, having cylinders 26 in., 42 in. and 70 in. by 48 in. stroke, supplied with steam by three large single-ended boilers working at 180 lbs. pressure, and fitted with Howden's system of forced draught. The vessel and her engines are being built under the superintendence of Captain A. D. Christensen.

Kossuth Ferencz.—On April 29th Messrs. Joseph L. Thompson & Sons, Limited, of the North Sands Shipbuilding Yard, Sunderland, launched this steel screw steamer, which has been specially built to the order of Messrs. The Atlantica Sea Navigation Co., Limited, of London and Budapest. The vessel has been built to Lloyd's highest class, under their special survey, on the three-deck rule, but with one deck laid, the principal dimensions being:—Length overall, 392 ft. 2 in.; breadth extreme, 52 ft. 3½ in.; depth moulded, 27 ft. 1 in., with long bridge, poop and topgallant forecastle. The deep frame system of construction has been adopted, leaving clear holds without obstruction by beams. Provision is made for water ballast in the cellular double bottom and in both fore and after peaks. The vessel is divided transversely by the usual water-tight bulkheads, and with additional wooden bulkheads. Special attention has been given to the loading and discharging facilities, fifteen of Lynn's steam winches being fitted, supplied with steam by a powerful marine type donkey boiler, and a very complete derrick arrangement. The accommodation for the officers, crew and spare cabins are commodious and will be handsomely fitted up. An electric light installation will be fitted throughout by Messrs. The Sunderland Forge and Engineering Co., Ltd., of Sunderland, and will include special arc lamps for working cargo at night time. The propelling machinery has been constructed by Messrs. Blair and Co., Ltd., of Stockton-on-Tees, the sizes of the cylinders being 26 in., 42 in., 68 in. by 48 in. stroke, supplied with steam by two extra large boilers working at 180 lbs. pressure. The vessel was gracefully christened by Miss Robson, daughter of Mr. D. M. Robson, of London, the company's superintendent, under whose supervision the vessel and machinery have been constructed.

Lady Lewis.—On April 29th Messrs. Richardson, Duck and Co. launched from their yard at Stockton-on-Tees a handsomely modelled steel screw steamer built to the order of W. J. Tatem, Esq., of Cardiff. The dimensions are:—Length overall, 363 ft. 6 in.; breadth, 49 ft.; depth moulded to upper deck, 26 ft. 3 in.; depth moulded to shelter deck, 34 ft. 3 in.; displacement co-efficient, ·77; gross tonnage, about 3455 tons; deadweight capacity, about 6400 tons. The vessel is built to the British Corporation highest class under special survey, and is of the shelter deck type, having 7 ft. 11½ in. between the upper and shelter decks, with deep bulb angle frames, six water-tight bulkheads and steel longitudinal centre cargo divisions; large cargo hatches flanged at bottom and exceptionally clear holds, there being no hold beams nor quarter pillars, and both as respects outfit and machinery, embodies all the latest improvements in modern shipbuilding and engineering practice. Special attention has been paid to accommodation for captain, officers, engineers and crew, accommodation for the former being provided in steel deckhouses on shelter deck amidships, all 7 ft. 6 in. high, and for the crew in extra large forecastles forward. Separate entrances are provided to the sailors' and firemen's accommodation, and their sleeping berths are of galvanized iron, Hoskin's Neptune patent. Accommodation is also provided for five 1st-class passengers in neatly furnished saloon and state rooms amidships, and for four apprentices in an extension of the after wheel-house, specially fitted. Bathrooms and large wash-houses are provided for captain, officers and crew. Cellular double bottom throughout, and fore and after peaks are arranged for water ballast, giving large capacity, with large pumps for dealing with same. Her equipment has been specially designed for rapid loading, discharging and general efficiency, and includes double derricks to all hatches, masts and derricks, all constructed for seven ton lifts; cross trees will be fitted on masts for special spans, and derricks at fore and main masts stepped on steel houses built round the masts, which form extra gear and store rooms. Equipment further includes eight Messrs. Clarke, Chapman & Co.'s improved heavy "Cyclops" pattern steam winches fitted with extra large whipping drums, also Emerson, Walker & Co.'s steam windlass with quick warping ends; Wasteney Smith's patent

stockless anchors; R. Roger & Co.'s steam steering gear, extra large, and designed for quick working; single plate rudder with coupling, McLachlan's patent; Richardsons, Westgarth & Co.'s winch condenser of the Contraflo type, to which all the exhaust steam from winches, windlass and other auxiliary machinery is taken. Bunkers, internal surfaces of cellular bottom, under main and auxiliary boilers, and tanktop in way of same are coated with bitumastic composition. Sanitation, lighting and ventilation have also received special attention, accommodation, bunkers and boiler-room tank being specially ventilated and four large ventilators to each hold fitted with improved weather proof tops. Fresh-water tanks contain 5000 gallons and there will be a large fresh-water condenser. Vessel will be supplied and fitted with engines by The North-Eastern Marine Engineering Co., Ltd., of Sunderland, cylinders 25 in., 42½ in., 69 in. with 48 in. stroke, steam being supplied by two single-ended boilers 16 ft. 6 in. by 11 ft. 6 in., 180 lbs. pressure. In addition to the above, there is also an auxiliary boiler 12 ft. by 10 ft. 6 in., 180 lbs. pressure, which can be used in connection with main engines when increased speed is required. Engines are fitted with all the latest improvements, including shafting of hydraulic pressed ingot steel. The christening ceremony was gracefully performed by Miss May Gibson, of Newport Road, Cardiff, niece of the managing owner, who named the vessel *Lady Lewis* as she left the ways. She is expected to be ready for trial trip early in July. This vessel is the fifteenth built by Messrs. Richardson, Duck and Co. to the order of Mr. Tatem.

Annette Furness.—On April 30th Messrs. Osbourne, Graham & Co. launched from their yard at Hylton the steel screw steamer *Annette Furness*, which they have specially constructed for Alfred Christensen, Esq., of Copenhagen. Her principal dimensions are 279 ft. by 40 ft. 1½ in. by 20 ft. 6¼ in. moulded. She is a single decker, with poop, bridge and forecastle, built with deep bulb angle framing, and carries 3150 tons on a shallow draught, and has been built to take Lloyd's highest class. The accommodation for officers has been fitted up in the poop, the cabins, saloon and mess-room being tastefully fitted out in hardwood. Engineers' accommodation is fitted around the engine and boiler casing, under the after end of the bridge. Vessel is equipped with the most modern appliances for economical working of cargo, the winches being supplied by Messrs. Clarke, Chapman & Co., windlass by Emerson, Walker & Thompson Bros., steering gear by Messrs. Lynn & Co., Ltd., and Cochran (Annan) donkey boiler with new patent seamless furnace. During construction the hull and machinery have been under the superintendence of Messrs. Wallace & Co., of London and Glasgow. As the vessel left the ways she was gracefully christened by Miss Suggitt, niece of Lady Furness. After the launch the vessel proceeded to Messrs. Geo. Clark, Ltd., of Southwick Engine Works, Sunderland, to receive her engines, cylinders being 20 in., 33 in., 54 in. by 36 in., two large boilers.

Dan.—On April 30th there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields, a steel screw steamer, named the *Dan*, built to the order of Messrs. Giovanni Racich & Partners, Ragusa. The vessel, which is 362 ft. over all by 49 ft. broad and 26 ft. 3½ in. depth moulded, has been built on the single-deck principle, with girder framing and large clear holds, and to Lloyd's and Austrian Veritas highest class, with extra long bridge and poop, which are available for cargo, and topgallant forecastle in which the crew are housed. Separate steel houses are built on the bridge deck for captain, officers and passengers, and alongside engine casing for engineers. She is fitted throughout with double bottom of extra depth to contain a large quantity of water ballast, as well as having a large after peak tank built for the same purpose. The machinery and boilers are also constructed by Messrs. John Readhead & Sons, the engines being of triple expansion type, having cylinders 24½ in., 41 in., and 66 in. by 45 in. stroke, steam being supplied by two large steel boilers working at a pressure of 180 lbs. per square inch. This is the fourth vessel built for Messrs. Racich by the above firm.

Idaho.—On April 30th there was launched from the Southwick Yard of Messrs. Robert Thompson & Sons, Ltd,. the steel screw steamer *Idaho*, built to the order of Messrs. B. C. Atkinson & Son, of Middlesbrough. She is a sister ship to the *Wyoming*, launched for the same owners a fortnight ago; her principal dimensions being :—Length, 176 ft; breadth, 29 ft. 10 in.; depth moulded, 13 ft., and is built to the highest class in Lloyd's. The erections consist of raised quarter deck, bridge amidships for the accommodation of officers and engineers, and topgallant forecastle for crew. There are three large hatchways worked by powerful steam winches by Clarke, Chapman & Co., Ltd., for the rapid loading and discharging of cargo; quick warping steam windlass by Messrs. Emerson, Walker & Thompson Bros., Ltd., and steam and hand steering gear by Messrs. Robert Roger & Co., Ltd. The engines are by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough, of the triple expansion type, having cylinders of 15½ in., 25 in. and 41 in. by 27 in. stroke, with two boilers of ample power. During construction the ship and her machinery have been personally superintended by Mr. James Summers, of Middlesbrough. The christening ceremony was gracefully performed by Mrs. B. C. Atkinson.

Venezia.—On April 30th the twin-screw steamer *Venezia* was launched from the Neptune Works of Swan, Hunter and Wigham Richardson, Ltd. This steamer is being constructed to the order of Messrs. Cyprien Fabre & Co., Marseilles, and is intended for their emigrant service between Italy and New York. She is a handsomely modelled vessel, built of steel to the highest class in the Register of the Bureau Veritas and to comply with the Italian and American emigrant regulations. She will be propelled by two sets of triple expansion engines supplied with steam from six large boilers. Both engines and boilers are also constructed at the Neptune Works, and are expected to drive the *Venezia* at a speed of over 16½ knots per hour. The vessel is about 470 ft. in length by 51½ ft. beam, and will be fitted with accommodation for fifty first-class passengers, consisting of a large dining saloon, writing-room, smoke-room, ladies' room, twenty-four state rooms, and one cabin de luxe, all situated in houses on the bridge deck and above. The remainder of the ship is fitted up for emigrants, carrying over 1800, in addition to which there are hospitals containing sixty beds. The owners were represented at the launch by Mr. V. Alexandre, of Marseilles, marine superintendent for MM. Cyp. Fabre et Cie, and Mr. Charry, their superintendent engineer. There were also a goodly number of visitors present, including the French Vice-Consul and the Russian and Portuguese Consuls, the French Consul was unable to be present owing to indisposition. Before the vessel left the ways a short benedictory service was held according to the rites of the Roman Catholic Church by the Rev. Canon Greene. After which, as the vessel left the ways, the christening ceremony was gracefully performed by Mrs. J. Denham Christie, of Tynemouth.

Saltmarshe.—On May 9th Messrs. W. Pickersgill & Sons launched from their yard at Southwick a finely-modelled steel screw steamer. Dimensions :—Length, 215 ft., breadth, 32 ft., and depth 15 ft. 3 in. Machinery and boilers are being supplied and fitted by Messrs. Geo. Clark, Ltd., Southwick. The owners are Messrs. J. H. Wetherall & Co., Goole, and during construction the vessel has been under the supervision of Mr. Thos. Wetherall. As the steamer left the ways she was gracefully named the *Saltmarshe* by Miss Wetherall, the daughter of one of the owners of the steamer.

Despina G. Michalinos.—On May 11th Messrs. William Gray & Company, Limited, launched at West Hartlepool the handsome steel screw steamer *Despina G. Michalinos* for Messrs. Michalinos & Co., of London and Piraeus. She will take the highest class in Lloyd's, and is of the following dimensions :—Length overall, 342 ft. 6 in., breadth, 47 ft. 6 in., and depth, 22 ft. 6 in., with extra long bridge, poop and topgallant forecastle. The saloon, state rooms, captain's, officers' and engineers' rooms, etc., will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom and large aft and fore peak ballast tanks, six steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on beams overhead and all requirements for a first-class cargo steamer. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders,

was the third turbine steamer they had built for the Union Company. Probably Mr. Jas. Mills, chairman of the company, who was present was the first amongst shipowners to think seriously of adopting the turbine for ocean service. In the latter half of 1901 the company had in view the building of the *Moeraki*, which was to have a speed of fourteen knots. Mr. Mills was so favourably impressed with the performances of the *King Edward* on the Clyde that he suggested turbines for their new vessel. Mr. Brock, his deceased partner, said they would fit turbines if Mr. Mills would take the responsibility, but he thought it was too big a step to go from a small 20-knot steamer to a large 14-knot steamer, and he advised caution. Mr. Mills acted on this advice, and Mr. Denny thought that the development of the turbine and the further information obtained in regard to it had proved fully the wisdom of the course then adopted. The first turbine steamer they had built for the Union Company was the *Loongana* which was running between the mainland of Australia and Tasmania. She was on a very arduous service, and it was not considered that she could have continued in that service so long and so constantly if she had not had turbine machinery. After Mr. Mills had received the *Loongana* he wished another vessel the *Makura* to run 16 knots at sea. She was the slowest vessel for sea service that had ever been built for turbines, but this 16-knot steamer had been breaking records all along the Australian routes. It was not a matter of sentiment with Mr. Mills it was a pure matter of business. If he had not been satisfied with the turbines he would not have ordered any more but he had ordered the *Maori*, which was to be faster than either of the others. If she came successfully through all the strenuous tests for which he had stipulated she would be a very satisfactory vessel indeed. Sir Joseph Ward in the course of his reply to the toast remarked that anyone who knew how fast things were moving in these times would realize the importance of the traffic between the two great islands of New Zealand and of the work that had been done by the Union Company in providing steamers like the *Maori*. The ceremony they had taken part in that day was to New Zealand a matter of more than ordinary importance. Theirs was a very go-ahead country and they were a very active people. There was no other country in the world that carried its population ten and a half times per year on railways. They were a travelling people, for one thing, because their country was a long string, and they required to travel long distances in order to carry on their ordinary business. The *Maori*, steaming 20 knots, would ensure to the Union Steamship Company the certainty of the traffic across the straits between the two islands. Mr. Peter Denny, in proposing "The Union Steamship Company," remarked that the *Maori* was the thirty-eighth steamer they had built for the firm. Mr. Mills, in replying, referred to the high-class vessels they had received from Messrs. Denny nearly thirty years ago, some of which, he said, were still in service, one of them with the original boilers. In concluding, he proposed "Messrs. Denny and Brothers," to which Mr. John Ward replied. The Union Steamship Company of New Zealand, it is of interest to add, have had altogether 120 ships on their books since the company was formed thirty four years ago, and with the *Maori* they have at present sixty-two in their fleet. The vessel which Caird & Co., Greenock, are at present building for them is to have twin-screw reciprocating engines.

Ostsee.—On May 15th, there was launched from the Castle Works of the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, for Messrs. L. Possehl & Co., of Lubeck, a steel passenger and cargo steamer 215 ft. 6 in. by 32 ft. by 16 ft. The vessel was named *Ostsee* by Mrs. Endeman, of Glasgow, and immediately after the launch was placed under the crane in the builders' dock to receive her engines and boilers, which have also been constructed by the builders. The hull and machinery were constructed under the superintendence of Mr. Lorzweiss, of Messrs. Possehl & Co., to Germanischer Lloyds rules, under the direction of Mr. Alex. Craig, of Glasgow.

LAUNCH—Irish.

Para.—On April 30th, Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their North Yard the second of the nine vessels of various types being built by them for the Lloyd Brazileiro of Rio de Janeiro. A party representing the owners and builders assembled to witness the interesting function, and as the vessel began to glide down the launch ways, the ceremony of christening and naming it the *Para* was gracefully performed by Mrs. Frank Workman on behalf of Madame Francisca C. Buarque de Macedo, of Rio de Janeiro, who fulfils the duties of sponsor for the vessel. The arrangements for the launch were of the usual complete character and the proceedings passed off in the most successful manner. Immediately on entering the water the vessel was taken in charge by the attendant tug boats and brought alongside the outfitting wharfs to receive the machinery and interior fittings. The *Para* is a vessel of 354 feet in length with a gross tonnage of over 3,500 tons and has been built to qualify for the highest class in Lloyd's Register, besides fulfilling all the requirements demanded by the Board of Trade for a foreign-going passenger steamer. The design and arrangements of the vessel have been made with special consideration of the requirements of the passenger and general cargo trade on the South American Coast. Accommodation has been arranged for some 170 first-class passengers, 20 second-class and 300 third-class. The rooms for the first-class passengers are on the upper and main decks, and in addition to the ordinary staterooms a number of cabins de luxe are provided; these suites consist of a sitting room, bedroom, bath room and lavatory. The first-class dining saloon placed on the main deck is a large, roomy and well-lighted apartment extending the full width of the vessel. From this saloon a wide staircase leads to the main entrance hall on the upper deck. This hall will be fitted up as a lounge, and opening off it are the cabins de luxe and principal staterooms, while a broad central corridor runs fore and aft with state-rooms opening off on each side. Large double doors on each side of this entrance hall open on to the deck. The main staircase continues from this deck to the entrance hall on the shade deck. The forward end of this hall opens into the music saloon and at the after end is the smoking room; both of these rooms being lofty and well-lighted apartments, suitably furnished. Double doors on each side of the entrance open on to the shade deck which affords ample promenading space. On this deck additional first-class staterooms and the officers' rooms have been placed in a deck house at the forward end of the funnel casing. The second-class passengers' accommodation has been arranged on the main deck forward of the boiler room, and includes a large central dining saloon with state rooms opening off alleyways on each side of the saloon. The steerage quarters are placed on the forward end of the main deck and include a separate apartment for women, the remainder of the space having been fitted up with iron beds and hammocks. The engineers and petty officers' rooms are fitted up in the midship house on the upper deck, while the top gallant forecastle has been arranged for the accommodation of the crew. An efficient system of natural and artificial ventilation has been arranged throughout all the living and public rooms, and the sanitary arrangements for each class are receiving special attention, while the galleys and pantries will be supplied with all the most modern appliances. Each of the four holds, into which the cargo space is divided by watertight bulkheads, is provided with suitable hatchways, equipped with powerful hydraulic cranes, capable of rapidly loading and discharging cargo. Baggage and parcel rooms have been arranged for the stowage of passengers' luggage, while mail and bullion rooms are being fitted up. Messrs. Workman, Clark & Co. have constructed the propelling machinery and boilers at their Queen's Road Works. These consist of two sets of triple expansion engines, having all the most recent improvements, and three steel cylindrical multitubular boilers, working under Howden's system of forced draught. Steam for the auxiliary engines and deck machinery is supplied by an auxiliary boiler. The designing and construction of the vessel has been carried out under the direction and supervision of Dr. A. Rosauro de Almeida, commander engineer of the Brazilian Navy, who is Technical Director-in-Chief for the Lloyd Brazileiro.

TRIAL TRIPS.

Felix.—Lately, the trial trip of the s.s. *Felix*, built to the order of Mr. P. A. Gron, of Sandefjord, Norway, has taken

place. The vessel, which is 200 feet long by 42 feet beam and 21 feet 10½ inches depth moulded, is of the well-known "Cantilever" type and has been built by Messrs. William Dobson & Co., Newcastle-on-Tyne, by arrangement with Sir Raylton Dixon & Co., under the Harroway & Dixon, John Priestman and Livingston & Sanderson patents. She has been built to the highest class of Norwegian Veritas and is specially constructed for the Canadian trade of the Dominion Steel Co. The vessel has exceptionally large hatchways and with the machinery placed aft, has, except for the masts, absolutely clear holds, the arrangement of framing dispensing entirely with beams and pillars, and the wing tanks also making the vessel quite self-trimming. The machinery is of the usual triple expansion type and has been built by the North-Eastern Marine Engineering Co., Ltd., at their Wallsend works. The cylinders are 22 in., 36 in., and 60 in. diameter by 39 in. stroke and steam is supplied by two large single ended boilers at 180 lbs. pressure. It may be interesting to mention that this ship carries her deadweight of about 3,550 tons on the very low net tonnage of 1,123 tons and has close upon 1,200 tons of water ballast. Her unusual steadiness in a rather rough sea and the complete absence of vibration, both largely due to the introduction of the wing ballast tanks, were much commented upon by those on board, who included the owner and representatives from Norwegian Veritas and from the builders and engineers.

Norman.—On April 22nd, the s.s. *Norman* (of which we gave particulars in our April issue, page 350), built to the order of Mr. Julius Christensen, for the Ocean Steamship Co., Ltd., Aarhus, Denmark, by Messrs. Osbourne, Graham & Co., and engined by Messrs. George Clark, Ltd., ran official trials off the Tyne, when a speed of 10½ knots was obtained, everything working satisfactorily. On board during trial were Mr. Julius Christensen, managing owner, Mr. Powell, of Alfred Christensen, London, Messrs. Paterson and Clark, representing builders and engineers, Mr. Tuxen, Bureau Veritas, surveyor, Copenhagen, and Mr. D. M. Wallace, of Messrs. Wallace & Co., naval architects and consulting engineers, London and Glasgow, under whose superintendence the vessel and her machinery have been constructed.

Transport.—On April 24th, the large screw steamer *Transport* (of which we gave particulars in our May issue, page 384), built by R. Craggs & Sons, Ltd., Tees Dockyard, Middlesbrough, for the London Traders Shipping Co., Ltd. (managers, Messrs. Tremellen & Thomas, of 22, St. Mary Axe, E.C.), proceeded to sea for her official trials. The results were pronounced entirely satisfactory to all concerned, the vessel registering an average speed of about 11½ knots in four runs over a four knot course. S. T. Taylor & Sons have covered the donkey boiler with their Tynos non-conducting material.

Neuenstein.—On April 25th, the fine new steel screw steamer *Neuenstein*, built by Messrs. Chantiers Navals Anversois, of Hoboken-les-Anvers, Belgium, to the order of Messrs. Seetransport-Gesellschaft, M.B.H., of Hamburg, had her official trial trip off Flushing. This vessel, which is 317 ft. 2 in. b.p., 44 ft. 6 in. breadth and has a depth of 23 ft. 6 in. to upper deck, has been built to Lloyd's 100 A1 class and has a deadweight capacity of 4484 tons on 19 ft. 10 in. draught and a net tonnage of 1641 tons. She is fitted with complete 'tween deck, also poop, forecastle and bridge, with hatches 30 ft. long, 18 ft. wide, the holds being arranged with wide spaced pillars and deep framing. The steamer, which is intended for the Mediterranean trade, is fitted with all the latest improvements for the rapid loading and discharging of cargoes. The propelling machinery has been supplied and fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., from their Northumberland Engine Works, Wallsend-on-Tyne, and consists of a set of their latest type of triple expansion engines, having cylinders, 22½ in., 37 in., 61 in., with a stroke of 42 in., steam being supplied by two large steel boilers, together with one auxiliary boiler. During the trial run of six hours' duration the machinery worked without the slightest hitch and gave great satisfaction to all concerned, amongst those present being Mr. Galetzschky, representing the owners and under whose supervision both hull and machinery have been constructed, Mr. M. O. H. Reilly, general manager of Messrs. Chantiers Navals Anversois, and Mr. H. Luhrs, representing the engine builders. Messrs. Chantiers Navals Anversois have six larger steamers in hand for the same owners, all of which are to be supplied with engines by Messrs. The North-Eastern Marine Engineering Co., Ltd., Wallsend and Sunderland.

Richmond.—On April 25th, the new steel screw steamer *Richmond* (of which we gave particulars in our April issue, page 352) launched by Irvine's Shipbuilding and Dry Docks Co., Ltd., and built for the Furness Line, proceeded to sea on her trial trip. After adjusting the compasses, the vessel ran a series of speeds over the measured mile, when it was ascertained a speed of 11½ knots had been attained, the vessel being in a half-loaded condition. She then proceeded to Barry to load for the River Plate. The vessel is equipped with a Cochran (Annan) donkey boiler with new patent seamless furnace.

Trevince.—On April 25th, the new screw steamer *Trevince*, built by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of the Hain Steamship Co., Ltd., St. Ives, was taken to sea on her official trial trip. The vessel is of the improved single deck type, to Lloyd's highest class and designed to carry 6,700 tons deadweight on a moderate draught, having a cellular double bottom all fore and aft and fitted with poop, long bridge and topgallant forecastle. Steel houses for captain and officers and also for engineers and apprentices are constructed on the bridge deck, the crew being berthed in the forecastle. The vessel is also fitted up with grain feeders in accordance with the Grain Cargoes Act. The engines and boilers have also been constructed by Messrs. John Readhead & Sons, cylinders being 25 in., 42 in., and 68 in. and 45 in. stroke and supplied with steam from two large steel boilers, working at a pressure of 180 lbs. per square inch. This is the fiftieth vessel built for the above firm by Messrs. John Readhead & Sons. After the trial, which was in every way satisfactory to all concerned, the vessel proceeded to Tyne Dock to load for the Black Sea under the command of Captain Blake.

Period.—On April 26th, the steamer *Period* (of which we gave particulars in our April issue, page 351), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesbrough, to the order of Messrs. Howard Smith & Co., Ltd., of Melbourne, Australia, proceeded to sea for her official trials. Mr. W. C. Foster, representing the owners, and a large party of friends were on board during the trials, which passed off most satisfactorily and the vessel proceeded in ballast on her maiden voyage to Australia under the command of Captain L. A. Leslie. The ship and her engines have been built under the superintendence of Mr. Foster. S. T. Taylor and Sons have covered boilers, pipes, etc., with their "Tynos" non-conducting material.

Pollacsek.—On April 26th, the handsome steel screw steamer, *Pollacsek* had her trial trip in Hartlepool Bay. This vessel is a sister ship to the *Grof Serenyi Bela*, whose trial took place about a week before. She has been built by Messrs. Wm. Gray & Co., Ltd., for Messrs. The Atlantica Sea Navigation Co., Ltd., of London and Budapest. She takes Lloyd's highest class, and her dimensions are: length over all, 342 ft., breadth, 48 ft. 3 in., and depth, 24 ft. 6 in. She has extra long bridge, poop, and topgallant forecastle. The saloon, staterooms, captain's, officers' and engineers' rooms, etc., are fitted up in houses on the bridge deck, and the crew's berths in the forecastle. Triple expansion engines have been supplied from the Central Marine Engine Works of the builders, having cylinders 24 in., 40 in., and 65 in. diameter, with a piston stroke of 42 in., and two large steel boilers adapted for a working pressure of 180 lbs. per square inch. S. T. Taylor & Sons have covered boilers, pipes, etc., with their "Tynos" non-conducting material and boiler bottoms with their Tynos patent removable asbestos mattresses. The owners were represented by their superintendent engineer, Mr. D. M. Robson, of London, the shipbuilders by Capt. J. E. Murrell, and the engine builders by Mr. Wm. Reynard. The results of the trial were satisfactory to all parties, the average speed of ship being 11 knots.

Grenada.—On April 27th, the steam fleeter *Grenada* (of which we gave particulars in our April issue, page 352), just completed by Earle's Shipbuilding and Engineering Co., Ltd., to the order of the Hull Steam Fishing and Ice Co., Ltd., was taken for her official trial trip. The vessel left the builders' slip on the early morning tide and after adjusting compasses anchored in the river. Later she proceeded to

the Middle and Bull lightships, between which marks, the full speed trials were run. These proved highly satisfactory to all concerned, a mean speed of 10¾ knots being attained, the engines working easily, and the boiler developing ample steam pressure. After a very successful trip the vessel returned in time to berth in St. Andrew's Dock on the evening tide. The owners were represented by Mr. J. Beath and the builders by Messrs. J. L. Read and L. Cubley. There were also on board Mr. J. Barclay (Lloyd's surveyor), Mr. Owen and Captain Rumble.

Pennsylvania.—On April 29th, the new steamer *Pennsylvania*, built by Messrs. William Dobson & Co. for Det Forenede Dampskibsselskab, of Copenhagen, was taken to sea for her official trial trip in fully loaded condition. The vessel is 354 ft. by 48 ft. by 28 ft. 5½ in. and is built to Lloyd's highest class three deck rule with two decks laid. The engines, which have been built by the North-Eastern Marine Engineering Co., Ltd., are of the triple expansion type with cylinders 24½ in., 40 in., 67 in. by 45 in. stroke with three large boilers fitted with Howden's forced draught. The trial was in every way satisfactory, a mean speed of upwards of 10½ knots being maintained on a low consumption of coals. The steamer is a pioneer, one of a new line which the owners intend establishing between Copenhagen and the River Plate. The owners' representative was Mr. de la Laing of Copenhagen.

Carbineer.—On April 30th, the fine new steel screw steamer *Carbineer* (of which we gave particulars in our May issue, page 384) built by Messrs. The Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne, to the order of Messrs. Fisher, Renwick & Co.'s Manchester-London Steamers, Ltd., of Manchester, left the Tyne for her official trial trip. The weather during the run was somewhat unfavourable, but notwithstanding this the machinery worked without the slightest hitch and maintained a speed of about 11¼ knots, which was considered highly satisfactory by all concerned. A large number of visitors were on board, amongst whom were Mr. J. Fisher and Mr. G. Renwick, of Messrs. Fisher, Renwick & Co., Mr. G. F. Mulherion and Mr. J. Bourn, of Messrs. The Tyne Iron Shipbuilding Co., Ltd., Mr. T. Harrold, under whose supervision both hull and machinery have been constructed, Mr. J. Daglish, representing Messrs. The North-Eastern Marine Engineering Co., Ltd.

Eugenie S. Embiricos.—On April 30th, the new steamer *Eugenie S. Embiricos* (of which we gave particulars in our April issue, page 350), lately completed by Messrs. Short Brothers, Limited, Sunderland, for S. G. Embiricos, Esq., of Andros and Cardiff, left the Wear for her official trials, during which, with a full cargo of 7500 tons on board, she made a speed of 12½ knots. The trial, which was in every way a complete success, was attended by the owner, Mr. Embiricos, and his superintendent, Mr. H. J. Richards, who has personally supervised the construction of hull and engines, Mr. P. Bebis, of Athens, Mr. F. Dickinson, representing the engine builders, and Mr. Joseph Short, managing director of Messrs. Short Brothers, Limited.

Rubicon.—On May 1st, having completed the S.Y. *Rubicon* in the very short period stipulated by their contract, Messrs. John I. Thornycroft & Co., Limited, ran some very successful trials with her at Chiswick to the entire satisfaction of the owner's representative. She is a particularly smart-looking craft, being carvel built of mahogany, close jointed and varnished inside and out. The decks forward and aft are also of mahogany. The floors are covered with American elm gratings. The length is 19 ft. 6 in., beam 5 ft., and the maximum depth 3 ft. 8 in. The power is transmitted by a Thornycroft 6-B.H.P. motor through a reversing gear to a Thornycroft solid propeller of large diameter specially designed for towing. It is anticipated that a towing speed of about four miles per hour will be easily maintained, and in view of the fact that the *Rubicon* is of 90 tons Y.M. this will be a very satisfactory performance. The fuel tank is of brass, and all petrol and water pipes are of solid drawn copper. The motor is completely covered and protected from rain and spray by a neat mahogany casing. The boat is provided with two hoods, one over the engine space and the other over the cockpit, each fitted with tale lights. Slings are provided for hanging in davits, and it is owing to the space and weight being limited for this purpose that special provision has had to be made to keep weight down to a minimum, while still leaving a good margin for strength. The contract stipulated 13 cwts., but the builders find they have ample margin, the actual weight being about 12 cwts., while the staunchness and seaworthy qualities are very apparent, and in no way impaired by the light construction. A boat of this type would be equally useful for up-river work or cruising in more or less sheltered waters, and its moderate initial cost, economy in fuel and maintenance should recommend it strongly to those in search of a small well-built and handy motor boat.

Oiz Mendi.—On May 9th, the S.S. *Oiz Mendi* (of which we gave particulars in our May issue, page 385), built by Messrs. Ropner & Son, Stockton-on-Tees, to the order of Messrs. Sota y Aznar, of Bilbao, made her official loaded trial, when she attained a speed of about ten knots per hour. The trial trip passed off in every way satisfactorily. The owners were represented by Mr. Goicechea and Mr. Undabarrena. Mr. Garthwaite was present on behalf of the builders.

Elizabeth.—On May 13th, the steel screw steamer *Elizabeth* (of which we gave particulars in our May issue, page 385), built by Messrs. Craig, Taylor & Co., Limited, Stockton-on-Tees, to the order of A. C. Lensen, Esq., of Terneuzen, was taken to sea for her trial trip, which proved highly satisfactory. During the whole of the run everything worked with the greatest smoothness, when a speed of 11½ knots was maintained. The owner, Mr. Lensen, and Mr. W. C. Carter, of London (the superintending engineer), both expressed themselves as being highly pleased with the ship and engines. After the trial trip the vessel proceeded to Blyth under command of Captain Van der Goot. A large company was on board. The vessel is equipped with a Cochran (Annan) donkey boiler with new patent seamless furnace.

Kovno.—On May 16th, the trial trip took place of the S.S. *Kovno*, which has been built and engined by Messrs. Earle's Shipbuilding and Engineering Co., Limited, of Hull, to the order of Messrs. T. Wilson, Sons & Co., Limited. The vessel is intended for passenger and general cargo trade between St. Petersburg and Hull, and is the third of four steamers which Earle's Company have constructed for the same owners for this particular trade. The fourth vessel is in a forward state and will be launched at the end of the present month. The *Kovno* is a handsomely modelled vessel 318 ft. by 41 ft. by 21 ft., moulded depth, and has a gross tonnage of 1985. She maintained an average speed of 13 knots, and the trial throughout proved highly satisfactory, both to the owners and to the builders. The passenger accommodation is of a superior character and, combined with her quick steaming, should make her a favourite boat with those desirous of travelling to and from St. Petersburg, the time now occupied by the passage under favourable weather conditions being considerably shortened. The system of separating the saloon from the state rooms has been adopted. There is accommodation for twenty-four first-class passengers, the state rooms being grouped amidships on the starboard side; the rooms are large, well lighted and ventilated and are fitted with all modern appliances and conveniences. The saloon and social-hall are built of solid oak, set off in panels and are upholstered in the very best style. There is a fine promenade deck over the saloon, also a large poop deck aft, both available for passengers. Large and comfortable quarters have been arranged for captain, officers and crew. The machinery consists of a set of triple expansion engines, supplied with steam from two large single-ended boilers working at 200 lbs. and fitted with forced draught on the closed ashpit system. The vessel is lighted throughout by electricity, and is fitted with the latest appliances for expeditiously dealing with cargo, weights up to 15 tons being handled without the assistance of shore cranes.

Alu Mendi.—On May 17th, the S.S. *Alu Mendi*, built by Messrs. Ropner & Son, Stockton-on-Tees, to the order of Messrs. Sota y Aznar, of Bilbao, made her official trial trip. The vessel has been built to Lloyd's highest class, and is of the well deck type having poop, bridge, quarter deck and forecastle, with clear holds and deep bulb framing. The accommodation for captain and officers is fitted up in the poop, with engineers in houses on bridge, and crew in top gallant forecastle. The vessel is designed to carry about

3300 tons on Lloyd's summer freeboard. She is fitted with double bottom for water ballast on the cellular principle, fore and aft, also in the after peak. Her appliances for loading and discharging cargoes expeditiously are very complete, and include four steam winches, steam being supplied by a large donkey boiler. She is fitted with triple expansion engines by Messrs. Blair & Co., Ltd., of Stockton, which worked very satisfactorily indeed. The trial trip passed off in every way satisfactorily, the owners being represented by Mr. Undabarrena. Mr. Garthwaite was present on behalf of the builders. This is a sister vessel to the S.S. *Oiz Mendi*, delivered about a fortnight ago for the same owners.

Memorial to the late Monsieur Augustin Normand. A representative and influential Committee has been formed in France, with the Minister of Marine as hon. president, for the purpose of raising a suitable memorial to the late Monsieur Augustin Normand, of Havre. It has been felt that many of the late Monsieur Normand's friends in this country might desire to place on record their high esteem for him, and their appreciation of his work in the advancement of the science of naval architecture and marine engineering. In accordance with the request of the French Committee and some of Monsieur Normand's most intimate friends in this country, including the Hon. Charles Parsons, C.B., Sir John I. Thornycroft, Sir William H. White, K.C.B., and Mr. A. F. Yarrow, Mr. Leslie S. Robertson, of 28, Victoria Street, Westminster, S.W., has consented to receive subscriptions from the British section of the profession of which Monsieur Normand was such a distinguished member. It is proposed that no subscription shall exceed £5.

BOARD OF TRADE EXAMINATIONS.

Extra First Class.

1907.

April 20th—Dakin, Norman	.. ..	Ex 1C London
,, 27th—Crichton, Alfred J.	..	Ex 1C N.Shields
,, 20th—Elton, Ernest F.	.. ..	Ex 1C London
,, 20th—Hull, George	.. ..	Ex 1C London
,, 20th—Jefferies, Harry	.. ..	Ex 1C London
,, 27th—M'Kenzie, Peter D	..	Ex 1C Liverpool
,, 27th—Newlands, George	..	Ex 1C Leith
,, 27th—Nichols, George H.	..	Ex 1C N.Shields
,, 27th—Reid, John Mc L.	..	Ex 1C Glasgow
,, 20th—Ritchie, Edwin G.	..	Ex 1C London
,, 20th—Stott, Andrew E ..	.	Ex 1C London
,, 27th—Stewart, Claude L.	..	Ex 1C Liverpool
,, 27th—Stokoe, Charles L.	..	Ex 1C N.Shields
,, 20th—Walker, George ..	..	Ex 1C W.Hart'l

NOTE—1C denotes First Class; 2C Second Class.

April 20th, 1907.

Allan, Arthur ..	2C W.Hart'l
Barratt, A. G...	1C Liverpool
Barron, S. J ..	2C Liverpool
Blackmore, Jas.	2C Liverpool
Blid, Emil J. ..	1C Cardiff
Boydgedes, C.	1C Leith
Bragg, John ..	2C Liverpool
Buchanan, A. D.	2C Glasgow
Burns, Hubert	2C N.Shields
Charlton, M. R.	1C N.Shields
Cowan, A .. .	2C Glasgow
Dadswell, P. ..	2C London
Davison, S. F	1C Cardiff
De Quincy, A. E	1C W.Hart'l
Dick, John A...	2C Leith
Dixon, Henry M	2C London
Duffin, John W.	1C Liverpool
Dunn, A. C. A.	2C Cardiff
Emmerson, J...	2C N.Shields
Franklin, A. ..	1C London
Gallagher, C. ..	2C W.Hart'l
Groundwater, H.	2C Liverpool
Hall, Harry I	2C Liverpool
Harrison, James	2C W.Hart'l
Hindmarsh, W.	2C N.Shields
Johns, E. J. ..	2C South'ton
Kambitsis, G...	1C W.Hart'l
Lock, W. A. ..	2C Hull
Laing, G. A. ..	1C N.Shields
Masey, A. J. ..	2C London
Mason, H J ..	2C London
M'Donald, J. ..	1C Liverpool
M'Gregor, A.T.	2C Liverpool
Millar, David ..	1C London
M'Intosh, J. S	2C South'ton
M'Leod, Alex...	2C Leith
Murray, J. D...	2C Glasgow
Newman, A. R.	2C London
Oldham, Fred..	2C W.Hart'l
Ormond, James	2C Glasgow
Pawley, W. O L	2C Cardiff
Pickering, R. H L	2C W.Hart'l
Prentice, Robt.	2C W.Hart'l
Rowe, Arthur E.	2C London
Ruthven, J ...	2C Glasgow
Sheraton, R. F.	2C N.Shields
Southworth, H.	1C Liverpool
Sprott, John D	1C Liverpool
Stevens, Wm...	2C Cardiff
Taylor, A. M...	2C Glasgow
Tellesson, W. G.	2C Liverpool
Thompson, A. E.	1C W.Hart'l
Thornton, J. A.	2C Liverpool
Walsh, John ..	2C Cardiff
Wilkie, A. S. ..	2C Leith
Williamston, J.	1C Glasgow
Wilson, Herbert	2C Cardiff
Woodland, B. T	2C Cardiff

April 27th

Adie, Thos. M.	1C Sunderl'd
Anderson, J. G.	1C Aberdeen
Bell, William ..	1C N.Shields
Bruce, Jas. H.	1C Sunderl'd
Cousins, D. F. .	1C Bristol
Cross, R. F. W.	1C Liverpool
Dixon, Chas. H.	1C Liverpool
Foster, Thomas	2C N Shields
Geddes, A. T...	1C London
Griffiths, W. O	1C Liverpool
Gurney, Wm. F.	1C London
Jenkinson, C. P.	1C London
Johnston, W.W.	1C N.Shields
Koster, Fred W.	1C N.Shields
Lusted, Bernard	2C London
Lynne, Vic. H.	2C Liverpool
Matthews, J. C.	1C Sunderl'd
Rae, Alexander	2C Greenock
Rattray, T. E. .	1C London
Rush, John	2C Sunderl'd
Smith, Edw. B.	1C N.Shields
Williams, W. J.	1C Bristol

May 4th.

Adam, L. McL.	2C Glasgow
Addison, F. W.	2C Liverpool
Anthony, Wm. .	1C London
Atkins, Henry F.	2C Cardiff
Bartlett, Jas D.	1C Cardiff
Bernon, Maurice	1C London
Blair, John S...	2C Glasgow
Boyd, J. R. B. .	2C London
Boyd, David S.	1C Leith
Brand, G. B. M.	1C Glasgow
Brebner, C. W.	1C South'ton
Brown, W. B. B.	2C Liverpool
Bryden, Wiiliam	2C Liverpool
Cleary, C. de L. C.	1C London
Comley, Jas. H.	2C Cardiff
Connacher, D. .	1C Glasgow
Coulthardt, R. L.	1C N.Shields
Crawford, David McN.	2C Glasgow
Dodd, Surtees F.	2C N.Shields
Duncan, James .	1C Leith
Eastman, E. T.	2C South'ton
Faragher, R. W.	2C Liverpool
Forbes, Wm. S.	1C Leith
Forsyth, John ..	1C Glasgow
Gow, Neil	2C London
Green, G. F. ..	2C Glasgow
Halvorsen, T. ..	1C Leith
Heard, Walter	1C London
Henry, Jas. T.	1C Liverpool
Hunter, Jas. H	2C N.Shields
Jones, Wm. E. .	2C Liverpool
Latta, Thos. O.	1C Glasgow
Lee, Joseph C.	2C London
Linklater, J. M	2C Liverpool
Lonsdale, R. G	1C N.Shields
Macfarlaine, R. J.	1C Liverpool
McCallum, J W	1C Glasgow
M'Cleery, W. J.	2C Belfast
Menzies, D.....	1C Glasgow
Merrylees, H...	1C Liverpool
Norman, Luther	2C South'ton
Padget, P. N.	2C London
Paton, James ..	2C Glasgow
Rhodes, Reg. ..	1C Liverpool
Ross, Andrew ..	1C Leith
Rosser, Wm. T.	2C Cardiff
Scott, Francis..	1C Cardiff
Sloan, James ..	2C Belfast
Suckling, W. J.	1C London
Thomas, T. G. .	1C Cardiff
Thomas, T. W.	2C Cardiff
Tithers, H. J. ..	1C Liverpool
Waddell, A. J. .	2C Belfast
Wallace, Hugh	2C Belfast
Watson, Robert	2C N.Shields
Wheeler, George	1C London
Wood, G. J. G.	2C Liverpool

May 11th

Aris, George F.	2C Liverpool
Bell, Harold S.	1C Liverpool
Bell, Henry....	1C Liverpool
Beardall, J. J...	2C N.Shields
Boswell, S. K.	2C London
Cook, Caleb, J.	2C Liverpool
Cross, Rene....	1C N.Shields
Currie, Wilfrid	2C N.Shields
Dunsmore, R...	1C N.Shields
Henshaw, H. ..	1C Liverpool
Ingrey, A. G. ..	1C London
Jones, Robt. M.	2C Liverpool
Matheson, P. C.	2C London
Purcell, W.H.M.	2C Liverpool
Rankin, C. W.	2C Liverpool
Rapley, John G.	2C N.Shields
Reeves, F. E...	2C London
Robert, T. J. ..	2C Liverpool
Salter, L. J. D.	2C London
Scott, David D.	1C N.Shields
Simm, C. L. ..	1C N.Shields
Smedley, C. S.	2C Liverpool
Sturge, Walter	1C N.Shields
Wakefield, W.F.	1C London
Walker, Thomas	2C Liverpool
Ward, Edward	2C N.Shields
Watson, Richard	2C N.Shields
Williams, Owen	1C Liverpool

May 18th.

Allan, William	2C N.Shields
Bagshaw, J. C.	2C Liverpool
Black, Duncan	2C Duncan
Blance, Robert	2C N.Shields
Bowman, H. H.	2C N.Shields
Bromfield, J. R.	2C Hull
Butler, R. W...	2C Liverpool
Clark, George..	1C N.Shields
Earnshaw, A...	1C Hull
Eggington, W.F.	1C Liverpool
Gibson, S M...	2C Greenock
Gray, Harry ..	2C Liverpool
Griffiths, T.....	2C Liverpool
Hall, Cyril	2C Greenock
Hetherington, Wm	1C Liverpool
Hitchin, W. J.	2C Liverpool
Howes, T. S. ..	2C N.Shields
Hunter, W. S.	2C Greenock
Jones, Albert S.	2C Liverpool
Jones, H T. W.	2C London
Leslie, Frank S.	2C Dundee
Martin, Arthur	1C Liverpool
McCracken, W.	2C Liverpool
McGregor, D...	1C London
McGregor, R...	2C Greenock
McMurrich, R M'G.	2C Greenock
Moxon, Alfred J.	1C Liverpool
Murray, John ..	2C Liverpool
New, Harry....	1C London
Norcross, A. C.	2C Liverpool
Portway, R. C. .	2C London
Rae, Arthur E.	2C Greenock
Reed, J. W. C.	1C N.Shields
Robson, C.L.W.	2C Hull
Robertson, S. A.	2C Dundee
Sale, Wallace A.	2C Liverpool
Service, J. W. R.	2C N.Shields
Summer, George	2C Liverpool
Thompson, G.H.	1C Liverpool

The Marine Engineer

And Naval Architect.

LONDON, JULY 1, 1907.

PROFESSOR ELGAR, who is always interesting, read a most lucid and thoughtful paper to those who were fortunate enough to hear him, when he delivered the James Forrest Lecture on the evening of the 18th June. The subject which he chose concerned the unsolved problems in the design and propulsion of ships, two subjects with which he is so familiar. His remarks on the genesis of the present free-board tables are worthy of note by those who are inclined to criticise the alterations that have recently taken place. He shows, too, how immense is the reduction in the toll of life taken by the sea, and that much of this benefit has been effected by the measures which have been taken for the due protection of deck openings. The figures he quotes are indeed striking. The number of lives of crews lost at sea has been reduced to one-fourth of what it was a quarter of a century ago, and the enormous increase of safety would be still more apparent if we were to regard the figures relating to the loss of life amongst steamers alone, instead of lumping those of steam and sail together. In what he had to say about the rules and tests relating to structural strength nothing perhaps is more surprising than the testimony which he pays to the genius of Brunel, as displayed in that commercial failure, the *Great Eastern*. Contrasting her with the ships comparable with her in size of the present day, he shows that she had adequate strength with less weight of hull than they, although the modern ship is constructed of steel 50 per cent. stronger than her iron, and also has the advantages of the great improvements which have taken place in the modes of riveting. He points out, too, that in some of the latest designs of cargo vessels which have great holds, with but a single-plate deck, there is a sort of reversion to her design, and he rather suggests that the designers of great passenger steamers might with advantage consider whether they, too, might not learn something from Brunel's masterpiece. In regard to the problem of speed, he shows how many practical difficulties attend the extension of the use of experimental tanks, and points out how, at least for the trial of screw propellers, a specially designed steam launch of some power may be the best means of gathering useful data. He has a good deal of interest to tell his hearers about the turbine engine, notably the fact that it is the question of how far it is economical in coal consumption that holds back some persons from pinning their faith to it. Again, in regard to the performance of channel steamers, it is interesting to note that the turbine-engined ship shows to advantage in bad weather. But a similar advantage is not to be noticed—at all events not to the same degree—in the comparative performances of ocean steamers. The cause of this difference is attributable to the immersion of the propellers in each case. Perhaps the most interesting point dealt with is that relating to internal combustion engines. First he stated the conditions which must be fulfilled by any model which bids for success, and finally closed the subject by showing that, till a material for cylinder casting can be obtained equal to withstanding the great changes of temperature which characterize the machine, the idea of 16,000 I.H.P. engines of this type can never be realized.

In regard to the question of comfort at sea—which looms so large in the eyes of passengers and of those who make it their business to cater for their wants—Dr. Elgar points out that most of the luxuries, such as lifts, restaurants and baths, come from the suggestion of managers, who have had opportunities of testing the wants of the travelling community. But the ship designer strives to meet the voyager's requirement in at least one important respect: he tries to give him a ship which shall attain the maximum of comfort in a seaway; and the lecturer pointed out how that problem has been attacked. Various devices to counteract rolling have been tried, but none have really been successful, and the ships with the best reputation are those which have been designed to have the longest period of roll. The paper is full of information, and shows us that, even with the magnificent vessels now afloat, there are still worlds for the able and ambitious designer to conquer.

THE conference of the Institution of Civil Engineers, which took place in the preceding month, has proved as successful as those preceding it. The popular president, Sir Alexander Kennedy, gave an opening address to the conference on Wednesday the 19th, in which he referred to the previous ten years during which the conference had taken place and hoped that the present one would prove not the least interesting and useful to the members. He hoped that members would not neglect to attend such papers as were not upon the work in which they were personally interested, as the broad-mindedness which such attention evidenced was to the general advantage of the institution. We must, however, only give notice of such papers upon machinery applicable to marine propulsion and also to papers upon ship-building, as being evident subject matter interesting to our readers. The Hon. Charles Algernon Parsons gave an interesting paper upon the general development of demands for turbines, both in the Mercantile Marine and in the Navy, as following the first noteworthy example of the *Turbinia* in 1897. He expresses these results as a diagram in which, as he points out, there was little demand for the turbine

in the first five years immediately following the introduction of the *Turbinia*, as by that time the total amount of tonnage for which the turbine was required did not exceed 40,000 tons, but he points out that in the next four years the demand for the turbine was increased for 75,000 tons, 150,000 tons, 270,000 tons, and eventually last year to 390,000 tons. It is noticeable from the diagrams as to the increasing tonnage of vessels for which the turbine has been required, that in the Navy it has run from the *Turbinia* through torpedo catchers to a cruiser, the *Amethyst* in 1904 and to the *Dreadnought*, one of the largest and heaviest vessels afloat. In the Mercantile Marine, we have the same progress from the *Turbinia* to Channel steamers and from them to Atlantic liners, such as the *Carmania*, the *Lusitania* and the *Mauretania* in 1907. It is to be noted that in the six years' work of the *King Edward* and the five years' work of the *Queen Alexandra* it is now found that less coal is used per indicated horse power, and that a better speed is maintained than during the first year, and that in war-vessels the power and economy of the reversing turbines is much greater than in the case of the earlier turbine vessels, which enables quicker manoeuvring to be carried out with reduced boiler power and with saving in coal. As a result of these lessons Mr. Parsons believes that for slow vessels a combination of turbines and reciprocating engines, the former to deal with the high-pressure part of the expansion and the latter the low-pressure part, will effect a saving of from 12 to 20% in coal consumption over the best triple expansion reciprocating engine.

IN the ship-building section of the Conference we find a paper read by Mr. Samuel J. P. Thearle upon the structural details of cargo steamers in relation to their water-ballast arrangements, which we consider gives excellent advice to the masters of such steamers and to the proprietors of the same. The water ballast as carried in tanks was first originated by an ingenious person who considered that the dealing with the ballast as water might be effected most economically as compared with gravel ballast. This gave rise to the McIntyre tank, now so well known in forming cellular bottoms, which was made a general form of construction, as the Board of Trade omit the whole of the double space at the bottom in measuring a vessel for tonnage. It is to be noted that the wastage of the said cellular bottoms under boilers proceeds very rapidly, therefore the extra strength given there to the bottom is very desirable in a new steamer to avoid the necessity of early renewals. The introduction of cold flanging in place of angle irons is not recommended, as it is generally recognised that the use of flanged floor plates does not provide the same rigidity of connection as an angle-bar. It is an open question whether a flanged construction of the double bottom is so well able to resist the stresses resulting from grounding or stranding as floors riveted to frames and reverse frames. The introduction of after-peak and fore-peak ballast tanks has proved useful in utilizing space which cannot be employed for other useful purposes, but the strength of such after-peak and fore-peak tanks depends almost entirely upon whether they are either full with water or left empty. It is noticed that damaging results will occur where the violent movement of the vessel in a sea-way moves about in the tanks the only partially filled contents of these tanks. Where the main tanks are of sufficient size so as to carry as much as 1000 tons of water, it is very necessary that these tanks should be full or empty, to avoid the dangerous stresses from the partially filled water when the vessel is violently agitated in a cross-sea, and it is recommended that at least two tanks should be used instead of one, when the total amount of water-ballast should amount to 2000 tons. As cargo is often carried in these deep water tanks, it must be remembered that the middle line longitudinal bulk-head is of great use to divide the said tank or to limit the floor of the water where the tanks are only partially filled. It is the tendency now to omit this middle line longitudinal bulk-head for the sake of the solid material to be stowed therein.

MR. A. E. Seaton gives a special paper testifying to the value afforded by high tensile steel in ship structure. He uses an algebraical formula as to the extra value that may be given by ship-owners for a steel whose elastic limits are 4 as compared with 3 for ordinary steel, and he thereby works out that, with a special price per ton dead weight, the owner can afford to pay at least £4 16s. 8d. extra cost per ton of material, whilst still leaving his cost price per ton of deadweight the same. He therefore holds that it will pay ship-owners generally to employ high tensile steel freely both in tubes and boilers, as very little will pay the extra cost of drilling, &c. The extra cost of working high tensile steel should be little or nothing, for even if it is necessary to drill and plane instead of punch or shear, with modern tools and special steel it can be done as cheaply.

IN the construction of the *Mauretania*, Mr. E. W. de Rusett has pointed out that the builders of this vessel came to the conclusion that high tensile steel should be used where the greatest stresses were encountered in order to save weight, the said steel to have the following qualifications:—An ultimate tensile strength of 34 to 38 tons per square inch, and an elastic limit of not less than 20 tons per square inch, the elongations to be not less than 20 per cent., and that the steel must stand the usual tests as to temper, cold bending, fatigue and mechanical tests. By an accompanying table the author believes that a

further reduction of 10 per cent. in the scantlings where high tensile steel is employed (making 20 per cent. in all) might, in his opinion, have been reasonably made in midship scantlings. The rivets recommended by Lloyd's Registry were to be of mild steel, which was consequently adopted.

FURTHER RESULTS OF SUBMARINE SIGNALLING BY MEANS OF SOUND.*

By J. B. MILLET, Esq., Associate.

ONE of the earliest instincts of the human race is for men to communicate with each other by means of sound. The air is a very fair conductor of sound, and the ordinary velocity is about 1,100 ft. per second. Water, however, as a conductor of sound is infinitely better in two respects: first, the velocity is about 4,700 ft. per second, or a little more than four times as fast; and, secondly, sound is not subject in water to certain obscure causes of disturbance as it is in air. A remarkable illustration of this fact recently came to my notice. A party of observers set out to test the sound range of a siren on a light-ship. All the conditions were favourable—a calm sea and clear, still air. The boat approached nearer and nearer the light-ship, but not a sound reached the ears of the listening experts. Suddenly at a distance of 600 yards, without the slightest warning, these gentlemen were all but deafened by a sudden roar from the siren, which continued until they boarded the light-ship. On inquiry it was found that the instrument had been sounding at its full pitch at frequent intervals for over three hours. Other illustrations of the unreliability of sound signals in the air under certain conditions were given in the discussion following the paper I read before this Institution in 1905.† I do not suggest for one moment that sound signals in the air should be superseded, but desire to emphasise the fact that, from the nature of the case, greater confidence may be placed in sound signals made in the water, both as aids to navigation, and as a means of communication between ships.

The idea of using water as a medium for carrying warning signals to ships is not a new one. In 1887 patents were granted to two Americans for submarine signalling apparatus, and in the following year the system which is now used on all the great Transatlantic liners was closely described in the patent applications of Messrs. Neale and Smallpage, two Englishmen. Unfortunately, their apparatus was inoperative and the means at their disposal did not enable them to study the peculiarities of sound in water (and on the ships it reaches) sufficiently to secure a practical result. In the first place, it is necessary to get a clear understanding as to the aim and object to be attained. The instruments used, to be practical, must enable those on board in charge of a moving vessel to hear sounds in the water, and to utilise them as warnings or signals. Unless the direction of the source of such signals can be located accurately and quickly, under varying conditions of weather, and without stopping the steamer, they cannot be considered practical. During the last twenty years many attempts have been made to solve this problem, and excellent work has been done by individuals. Professor L. J. Blake, working in connection with the Lighthouse Board of the United States, has been a prominent worker in this field; but the system of signalling described in this paper owes its initiation to Mr. A. J. Moody, of Boston, U.S.A. Mr. Moody was unaware of the work done by his predecessors when he became interested in the subject in 1900; but with the help of assistants he laid the foundation of the system which we have developed, by applying existing knowledge of the principles governing sound in water and making it possible to strike a note on a bell under water at regular intervals, and to enable the navigator of a ship to receive these sounds without leaving his wheel-house. A large body of experience gained in the last three or four years, proves that this new aid to navigation will be the means of saving many lives and much property.

The difficulties to be overcome in reaching this result have been very great, as little was known of the subject. It may be convenient to repeat a few details of our experience given in my former paper. The first bells used weighed 1,000 pounds and were cast for church steeples. After many experiments under difficult conditions and facing risks inevitably attending experiments made in the open sea, it was discovered that the higher tones of these bells which were weak in the air were the notes possessing the most penetrating qualities in the water. Bells, were, therefore, cast with less than one-half of the diameter first employed, and with a thick lip; these were found to produce a high, clear note of rather higher pitch than the middle C, and they weighed only 150 pounds. In this manner the problem of designing a practical submarine bell-buoy has been greatly simplified.

There are now three main systems of using bells under water:—(1) Bells suspended over the side of the vessel and lowered about 25 ft. below the surface of the water; the blows are produced by the action of compressed air; and are controlled by a code-ringing device in the engine-room, so that each light-ship rings its own number; (2) Bells supported on tripods placed on the floor of the sea, and operated by electricity sent along a cable from a power house on shore; (3) Buoys supporting submarine bells some 25 ft. below the surface. Above each bell is a disc working on the principle of a sea anchor; the difference in movement between this disc and the buoy operates a delicate but reliable mechanism, and with waves only 6 in. in height two blows a minute can be struck.

The character of the sound produced in water is of the greatest importance. When it reaches the ship it must have qualities that distinguish it unmistakably from any other sound; that is to say, it must be musical, and the vibration must have such an appreciable duration that the sound could not be confused with noises within the ship produced by pumps, or other auxiliary machinery. A bell of some sort rung under the water was, obviously, the simplest and most practical form to try first; and those workers who have perfected the system began with bells, and have never abandoned them. In the course of the experiments, however, trials have been made with many ingenious devices, such as reeds vibrated by an impinging stream of water, or other similar devices. The early experiments were very difficult to conduct, since all the work had to be done under water, and the results were misleading and discouraging, first, because there were no precedents to fall back upon, and, secondly, because the microphone had not been perfected. A large number of the trials proved failures, because the microphones were unsatisfactory, although they were thought at the time, to be due to imperfect bells. It will be seen, therefore, that an invention which has to be perfected under such circumstances, by weighing one result against another, without accurate knowledge of conditions, called for great devotion to the cause, both on the part of those who were doing the work and those who supplied the funds for a very large expenditure on the research.

Experiments have proved that the bell can be distinctly heard on board ship, on a vessel travelling at high speed, twelve to fifteen miles from the source of sound. There has been no proved failure of the system, although some persons have expressed doubts. Strange things have happened in the trials. One experimenter was dissatisfied because he could not hear the bell at a moderate distance, when other observers heard at greater distances. This disturbed us momentarily, but it was soon shown to have no bearing on the future of the invention, as the gentleman complaining was discovered to be very deaf.

In order to understand how these signals are made available, we must first conceive a bell rung about 20 ft. or 25 ft. below the surface of the water. The notes do not lose their musical tone, and the interval between successive notes is regular, if the bell is properly made and operated. The sounds are so much like the sound of a bell in the air that they can be

*Read at the Bordeaux International Congress and Summer Meetings of the Forty-eighth Session of the Institution of Naval Architects, June 26, 1907.

†Trans. I.N.A., Vol. XLVII., p. 256.

immediately recognised. A novice in the wheel-house of a ship fitted with the receivers and indicator box is immediately able to determine the position of the bell within one-quarter of a point. This has been actually done at a distance of from 12 to 14 miles from a light-ship. One master writes from the s.s. *Arranmore*, of Boston, on March 23rd, 1906: "My wife used the apparatus during a part of the time, and, although she had never seen it before, had no difficulty in getting the direction as well as I could myself." Indeed, a ship floating in the water is a most excellent collector of sounds submarine. The bell notes readily penetrate the hull, and may often be heard by an observer standing in the hold. By placing one's ear against the skin of the ship, the notes may be distinguished at long distances when the ship is quiet. It is, however, infinitely more advantageous to eliminate the possibility of human error and to bring the sound of the bell up into the wheel-house. The noises of the ship, especially in steamships, interfere with the bell-note, and the direction of the source of sound cannot be ascertained except in a general way, unless an indicator box is fixed in some convenient position for the captain or pilot.

The perfecting of the receiving apparatus was a very important factor in the system of submarine signals. In the first experiments, a tank was let over the side of the ship, but this plan was naturally found impracticable for vessels travelling at a high speed. It was said that it would be absolutely impossible to have the tank on board, owing to the noises on a ship, and that it would be impossible to distinguish the bell from a riveter's or a carpenter's hammer. Nevertheless, a practical solution has been found in using the ship itself as a sound collector, and in securing the tanks to the skin of the ship, and the success of the system has thus been assured.

The steps that led up to the present form of apparatus have been described in my earlier paper (of 1905); suffice it to say that the apparatus for receiving the sound now consists of two metal tanks about 22 in. square filled with sea water, fastened securely against the inside skin of the ship below the water-line, and placed at a certain demonstrated distance from the fore-foot, varying according to the shape of each individual ship. A specially designed microphone is suspended, wholly immersed, in each tank; and wires connect this microphone with an indicator box on the bridge, pilot-house, or elsewhere. This box is of metal, circular in shape, and is fitted with two telephonic earpieces or receivers, enabling two observers to listen simultaneously. By the simple process of moving a switch the listener can locate the bell as being either on his port or starboard hand. As a provision against accident, a second set of microphones is placed in each tank, and by manipulating another switch on the indicator box the operator is enabled to connect either set at will. This short description of the invention indicates the simplicity of the instruments as at present devised.

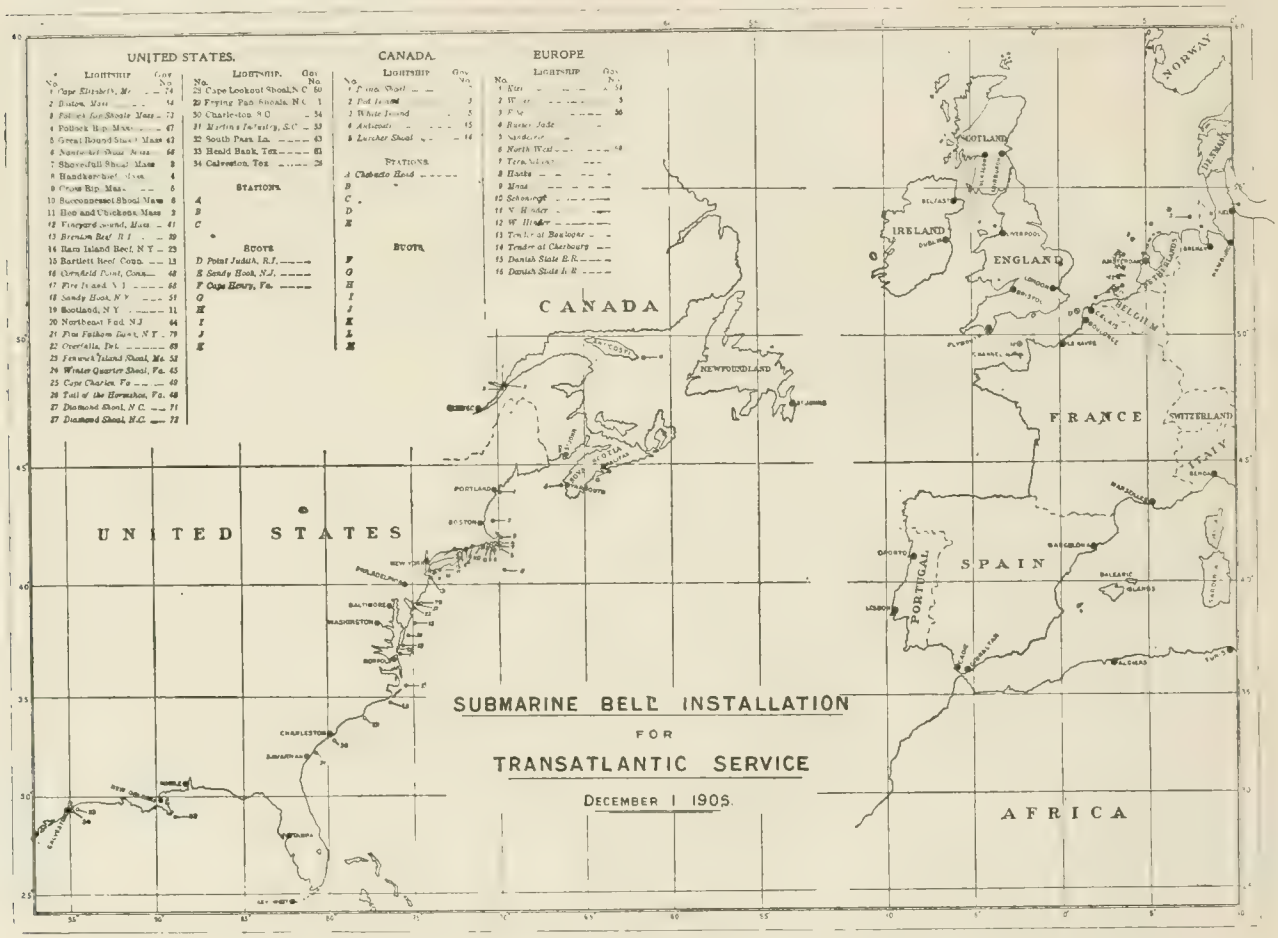


Fig. 1.

The principle as an aid to navigation has been thoroughly tested on the steamers of the great Transatlantic lines, and the reports have been uniformly satisfactory. Such confidence has been established that navigating officers on these lines are now instructed to alter their course, if need be, in obedience to the submarine signals they receive from the lightships or bell buoys in a fog or thick weather. Considering the conservatism of sea-captains and their natural unwillingness to adopt anything so revolutionary as this invention, it seems remarkable that so much progress has been made, and I can only account for it by the fact that the instinct to communicate by sound is so inbred in them that they naturally fall back upon it when anxious for the safety of their ships, when approaching

a coast in fog. As a matter of fact, they are now certain, after continued trials, that they can rely absolutely on the signals they get through the water.

To arrive at a proper appreciation of the value of submarine signalling, I must again remark that signals in the air are subject to the interference which wind, fog, and storm bring with them. Frequently the most efficient sirens known to

Fig. 2 General view of the Submarine Sound Signalling System.

the lighthouse services of Europe are rendered useless by the violence of the wind, which carries the sound with it. The recent loss of the *Suevic* reminded the world of this fact, and of the untrustworthiness of air signals. A heavy gale blowing from the ship to the shore prevented the note of the siren from reaching the ship, where, no doubt, eager ears were listening for it in vain. Seamen who are familiar with the use of sound signals, agree that they are not a safe guide to rely on solely, and it is the experience of scientists like Tyndall and others that they must always remain so. Water, on the other hand, as a medium for carrying sound, is not affected by wind or storm; it transmits the sound waves in all directions at a speed four times greater than the air; it is not affected by tides or currents, owing to the fact of the rapidity with which the sound travels. There is another all-important fact for purposes of signalling between ship and ship:—as air is much lighter than water, the sound passes

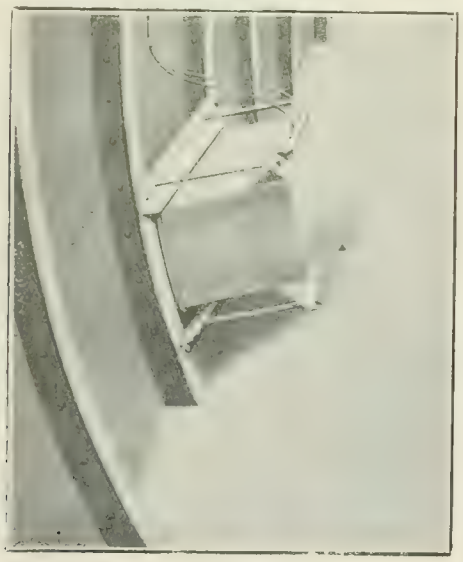


Fig. 3 The Tank.

reluctantly from water into air; and, therefore, sound signals remain in the water and cannot be confused with any other sounds. There is, therefore, little or no risk of any ship in a fleet not receiving orders from the flagship simultaneously with other ships. The chances are small of a foreign fleet, either equipped or unequipped with signalling apparatus, "tapping" the instructions from an Admiral to his fleet, if the code used, as is already done with flag codes, is communicated only to his own fleet. Of course fog does not intercept the giving and receiving of signals. Nor are they as evident as light signals.

It may be of interest to recapitulate briefly what has been already done in the way of fitting ships and lighthouses. Taking my own country (the United States), first, we have signals fitted on light-ships from almost the most northerly point, that is to say, Portland, in Maine, continuously down the East Coast past Cape Hatteras to Savannah, making a total of thirty-four light-ships and three bell-buoys. Where necessary there are two or three continuous stations, which tap out their warnings to vessels as they approach the ports. At New York, for example, a vessel coming from the east picks up the Nantucket shoal; soon after she has passed it she will hear the Fire Island warning, and before she has dropped that she will catch the warning notes from Sandy Hook, which will guide her right up to the Sandy Hook bell-buoy. Vessels fitted with a receiving apparatus have been known to go straight into New York in a thick fog, whereas

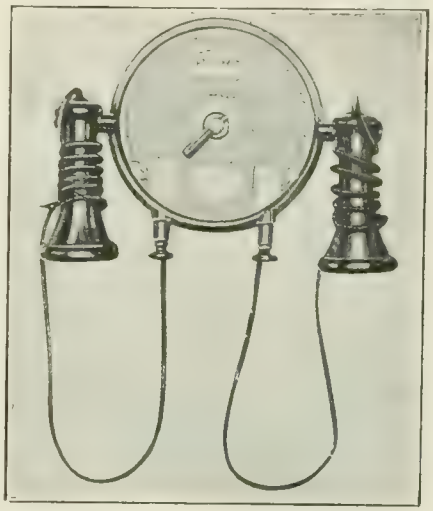


Fig. 4. Indicator Box.

other vessels have had to lie to at an enormous expense of coal and loss of time. Canada is launching out, and has already five light-ships and one shore station, and there is every chance, now that they have started the use of bells, that navigation will insist on the number being increased. In Europe the most go-ahead country in this respect is Germany. Here already the Kiel, Weser, Elbe and six other light-ships are either in operation or being fitted. In France two experimental stations for submarine signals have proved the utility at Boulogne and Cherbourg. There are also two in Denmark. In England, perhaps owing to her ancient institutions, only one such station has so far been established, on the North-West Light-ship at Liverpool, but the necessity for increasing the stations is generally recognised. Of the ships that have been fitted with receiving apparatus, the principal lines using the system are:—

North-German Lloyd	13	ships.
Hamburg-American	12	,,
Holland-America	5	,,
Cunard Line	8	,,
Canadian Pacific	13	,,
French Line	3	,,
White Star	13	,,
Pittsburg S.S. Company	12	,,
Metropolitan New York	6	,,
Boston-Philadelphia	4	,,
American Line	4	,,

A total tonnage of 1,341,210 of shipping now has receiving apparatus fitted. The English Government and the German and French Governments have approved and adopted the system for various classes of vessels, including submarines, pilot boats, and steam yachts. H.M. King Edward's yacht

Victoria and Albert and H.M. the Emperor William's *Hohenzollern* are in this list. There is no doubt that the results obtained by vessels demonstrate the extreme utility of the submarine bell as an adjunct to coastal navigation in thick weather. To quote the words of the report made by a Committee of Officers of the Royal Navy to the British Admiralty: "The fog signals at present in use cannot be depended on to be heard under all conditions, even at two miles' distance, and a vessel failing to make out a fog signal may be on a safe course, and in her estimated position, yet she must stop or anchor or alter her course because she is uncertain. The submarine bell increases the range at which the fog signal can be heard by a vessel until it approximates to the range of a light-vessel's light in clear weather; and, moreover, its bearings can be determined with quite sufficient accuracy for safe navigation in fog from distances far beyond the reach of aerial fog signals if the vessel is equipped with receivers. To double or treble the distance at which fog signals can be heard is a great advantage to shipping, and the facility of determining the direction of sound signalling is in itself a very valuable discovery. The installation of submarine bells in light-vessels must come sooner or later, as is proved by the rapid extension any nation has given it who has adopted this system in one or two light-vessels. Those who wait

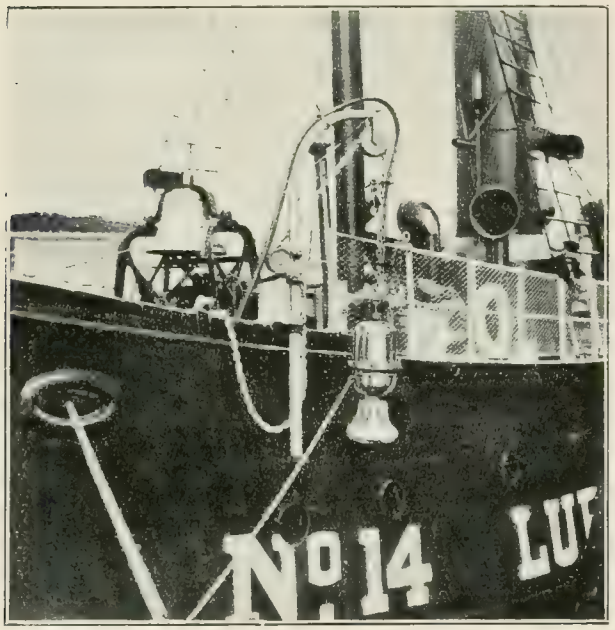


Fig. 5. Bell attached to Light-ship.

longest will incur the greatest loss in the meantime, both in ships and lives and through delays to shipping, which would otherwise be avoided."

A few practical illustrations of the use of our system of signalling may be of interest. The following quotation is made from a letter written by the master of the *Kaiser Wilhelm II.*, of the Norddeutscher Lloyd Line:—

"On the entrance of the *Kaiser Wilhelm II.* to-day into the Weser, the submarine bell on the Outer Weser Light-ship was heard with the starboard receiver one point to starboard at a distance of about 10 knots. There was a thick fog, with a light S.W. wind and calm sea. The course was changed one point to starboard, whereupon the bell, after this change of course, was heard only with the port receiver, so that it was evident the light-ship must be located about one point ahead as a result of this change of course which was proved later to be correct. The fog signal of the light-ship was heard thirteen minutes later than this, and in the same direction from which we had already received the bell signal. We sighted the light-ship about 3.19 p.m., and passed the same about 3.25 p.m. close by, on the port side.

Shortly after the first location of the submarine signal, we passed three ships which were not equipped with submarine signal apparatus, and which were still seeking to find the Weser Light-ship. The certain location of the position at a distance of about 10 knots, in a heavy fog, again proves the extraordinary usefulness of the invention for the safety of navigation in all kinds of bad weather."

On another occasion, a German passenger steamer, approaching the Weser, ran into fog. As no bell was heard from the outer light-ship, a message was sent by wireless telegraphy, asking that the bell might be set ringing. At the light-ship there was no sensible fog and the bell had been silent. When it was rung the steamer heard it at once, and shaped her course with certainty.

At Cherbourg the steam-tender to the German liners calling there has been fitted with a bell, hung in a compartment flooded with sea-water. When fog prevails, she proceeds outside to meet incoming steamers, rings the bell, and is heard on board the steamers, which thus determine their position and find their way into port.

These few examples, out of many that might be given, bring home the value of the system to those who have not had practical experience of its working. I would most seriously

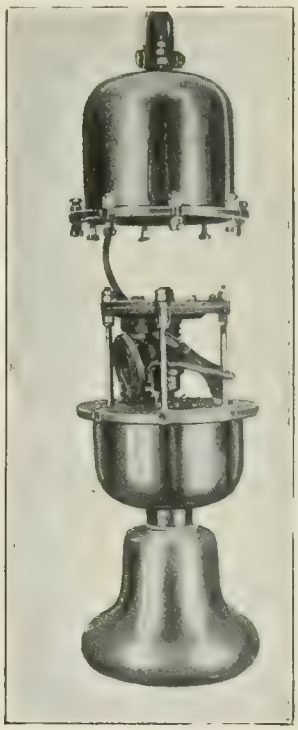


Fig. 6. Pneumatic Bell.

recommend anyone interested in practical navigation not to be satisfied with the few words I have been able to give you to-day, but to arrange to test the apparatus himself. There is nothing which brings home the utility of an appliance like practical experience. Submarine signals will, undoubtedly, prove to the seaman an aid such as he has never had before in navigating in a fog; it will also prove a source of economy to shipowners by effecting savings in time, coal and working expenses. Shipping companies in these days cannot afford to neglect any opportunity of utilising labour-saving and economising apparatus. Nor can any Government authority afford to neglect a safeguard to navigation. Pressure brought by the leaders of the shipping world upon their respective Governments, will eventually lead to the establishment of submarine bells on light-ships and at lighthouses and stations. I look forward to the day when all the principal ports along dangerous coasts will ring out their warnings to vessels that they are approaching dangerous spots; when every vessel of a reasonable size will be fitted not only with receivers, but possibly also with bells of their own, so that one ship will be able to locate another in a fog, and that each will be able

to locate its exact position with respect to fixed points; when ships will be able to enter ports without the risk of the calamities of which the papers report several each stormy and foggy day; when loss of life would be minimised, and fewer vessels sunk through ramming each other in a fog. If these results are attained, we shall feel that we have been instrumental in leaving navigation a good deal safer than we found it.

On the accompanying map (Fig. 1), are shown the stations already fitted with submarine bells, and the illustrations (Figs. 2 to 6) show the essential features of the system.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Great Western Route to Ireland.

IT is announced that owing to the unexpected measure of success which has already been achieved by the new Fishguard route to Ireland, the directors of the Great Western Railway Company have felt themselves justified in ordering a fourth steamer—sister to the three already on the station—for the service. For a time it was a little in doubt whether Birkenhead or Clydebank would get the order. But that doubt was soon ended and the St. Andrew—as the new ship will be called—will come from the Scottish yard, which has already provided two of the three ships of the Fishguard division of the fleet.

I have not personally had opportunity to see Fishguard or its steamers and ports. But it would seem to me that from what I have seen of the mail trains at Paddington and down the line, that the measure of success which the line has achieved is not so great as one would expect from the statement that the directors are more than satisfied with its results, whilst I have also heard whispers—which may or may not have foundation in fact—that the landing facilities on the route, as at present developed, are not altogether up to the exacting standard of the present day. I can remember, of course, when it was the usual practice—a practice which travellers accepted as quite a proper part of the proceedings—for passengers to be landed from boats at Llandudno, and even at Douglas, Isle of Man. But these things have long become a mere tradition on modern stations, and steamer-to-train facilities are more insisted on than those of steamer-to-quay were a mere quarter of a century ago.

A Case of Salvage.

An interesting story and an unusual point of law were both disclosed in the suit by the Russian Government brought against the London steamship *Hampstead* for salvage services rendered to her by the *Yermack*, in the Admiralty Division a few days ago. It may be remembered that in the month of August, 1905, the Russian Government despatched an expedition to the Yenesei river in Northern Siberia. This expedition seems to have been extensive and complete. It comprised altogether four large merchant vessels—one of which was the *Hampstead*—six or seven tugs, a dozen Rhenish lighters, a Russian warship, and last, but not least, the famous Russian icebreaker *Yermack*. The cargo of the *Hampstead* and of at least one other of the big merchantmen consisted of railway-iron and cement in bags, which was obviously going out on account of the Russian Government, and the whole force seems to have been under the command of a military officer, Colonel Sagieff, though one would have imagined that the commander of the *Yermack*, who was a captain in the Russian Navy, ought to have ranked as high as a colonel, and might have been supposed to be quite as qualified to command such a force as any soldier. But this has nothing to do with our story. By the 19th August the *Hampstead* and the *Roddam* were at Alexandrovosk, and it was originally intended that the whole flotilla should proceed thence in company. But as some of the craft only made five knots, and that only under favourable circumstances, instructions were given, whilst the ships were at that port, that the rendezvous was to be changed to Dickson Island, off Lamchina Bay. In making that place the master of the *Hampstead*, owing to the obscurity of the light, mistook his distance and went on the rocks. Eventually, after jettisoning a good deal of cargo and having valuable assistance from the *Yermack*, she was floated from a really dangerous position and one which, had the wind changed to a certain quarter and blown hard, might easily have proved fatal to her. The *Yermack* claimed salvage. The owners of the *Hampstead* resisted the claim on the necessarily unusual plea that the two ships were on a joint adventure and that thus there was a community of interest between them. Mr. Justice Bargrave Deane refused to entertain the plea, thus put forward, on the ground that the *Yermack* was provided to aid the other ships after leaving Dickson Island and that, therefore, when the services were rendered the joint adventure had not yet begun. A good deal could obviously be argued against the judge's view. But he tried to split the difference by giving what he considered a small award—£1000—and of that fixing a less proportion than usual as the share of the Russian Government who appeared as owners of the *Yermack*, on the ground that they were just as much interested in the salvage, as owners of the cargo laden aboard the *Hampstead*, as were the owners of that ship themselves. The case is one which may be remembered for future reference, though it would seem that the point of the decision was, as it turned out, a very narrow one.

The Australian Mail Contract.

At one time the future of the proposed company established for the carriage of these mails in the place of the Orient Royal Mail Line looked perilously shaky. But the Government of Victoria has pluckily come to the rescue and offers to guarantee the whole of the money, £125,000, which the syndicate requires, though upon certain conditions. These are to the effect that the guarantee shall only come into effect when the whole of the intended fleet is completed and ready for sea. That in return for it a mortgage shall be given to the State upon the whole of the eight vessels contemplated for the service. That the Government shall have a call on no less than 1200 tons of refrigerated space in each ship. That the Government shall have an official director on the Board, and, that other of the States be allowed to join in the guarantee if they signify their desire to do so within six months.

This offer is, of course, subject to ratification by the Victorian Parliament. In some aspects it looks rather a hard bargain. I do not see that there is much to complain of in the stipulation about the director. That is right enough. Nor does the clause about refrigerated space matter. The Government will have to pay current rates for it, and it matters little to the company who takes it, so long as it *is* taken. Nor does the chance given to the other Governments signify an atom. The Victorian Government has secured its advantages and it matters little to the other side whether or no the State holds them altogether or whether it splits them up. The two first points are those on which possible difficulty may arise. How will the fact that the guarantee is not to come into effect till the ships are ready to go to sea affect the credit of the new company in placing their orders? Will it set prices against them? Further, considering the value of the fleet when completed and ready for sea, it would seem that the Government is getting a pretty big security for its money. Possibly, however, the contractors are to be allowed to pay the sum off as soon as they like and are in a position to do so.

The first place according to the

Standard of Luxury at Sea

has hitherto always been taken by the Atlantic, and no doubt, even now, vessels built and building for it offer conveniences which are to be found on no other sea. But surely the increase of luxury in other waters has in recent years been more remarkable than on the Atlantic. One can remember when the old P. & O. *Shannon* was the crack ship on the cross Mediterranean route. This vessel was built in 1881 by Messrs. Harland & Wolff and was of under 4200 tons gross register. A few years later the Nord Deutscher Lloyd began running their *Hohenzollern*, which as *Kaiser Wilhelm II.*, had been found the luxurious ship of her day, though she was not altogether a success on the Atlantic. More recently we had the Hamburg Line procuring the yacht-like *Scot* from the Union-Castle Line for this trade, It was, of course, one for which she was obviously suited.

as she was never a cargo-carrier and the work upon which she was to be put was pre-eminently that of carrying first-class passengers. Now we have the Egyptian Mail Company far surpassing the Hamburg line's crack vessel with their new *Heliopolis*, launched on the last day but one of May from the Fairfield yard. This ship and her sister compare in size with the *Campania* and *Lucania*, being of but a thousand tons gross register less than they. But they naturally differ in many respects from them, owing to the difference in the trades for which the two sets of sisters are designed, and owing, too, to the advance in the science of shipbuilding and in the art of luxury which has taken place of recent years. To begin with, the new ships will not realize the speed of the two Cunarders, which still hold the proud position of being the fastest ocean vessels under the British flag. But nevertheless the *Heliopolis* and her sister will knock a day and a half off the passage between Marseilles and Alexandria. That is the proper thing, according to modern ideas, no doubt. But the cynical observer may ask why take so much trouble to make the voyager comfortable beyond his expectations, and then charge him extra to enjoy that comfort for a phenomenally brief period ?

The new ships have seven decks, all of which are connected by electric lifts. The main saloon seats 266 passengers at one sitting, whilst the second-class accommodation is also on a proportionately colossal scale. *Suites de luxe* are provided for those who are anxious to spend money, whilst the ordinary first-class passenger may be sure of not having more than one companion in his state-room. Further, it may be remarked that he has a chance of one of a large number of single-berth rooms. Finally, for the convenience of families and parties, there are little blocks of flats available, where friends may find their accommodation fairly self-contained. It is curious to reflect on the possibilities remaining open to those who would go one better than the latest products of our British shipbuilding yards. With turbine engines and bilge-keels, coupled with the vast dimensions now attained, one feels that perhaps the provision of a billiard-room may some day cease to be treated as the one thing which is not open to the progressive designer. Needless to say, the *Heliopolis* has turbine engines. They are to develop some 18,000 I.H.P. and to make 340 revolutions a minute.

The Allan Line

has issued a little pamphlet which is well worthy of my readers' attention. It is a reprint of an article contributed to the *Canadian Magazine* by Mr. Randolph Carlyle. The writer traces the remarkable development of the premier company in the Canadian trade. The history of that company has often been dwelt upon in these columns, and one recognises the enterprise which has ever characterized the managers, who have always been amongst the first to adopt every new invention which is calculated to add to the safety of their ships and passengers and to the comfort and convenience of the travelling public. But he does this and more. He shows to the general reader how great is the cost of a few extra knots when high speed is already attained, and how little would really be gained by the establishment —at terrific expense—of a twenty-five knot service to the St. Lawrence, when already, in the new turbine ships *Victorian* and *Virginian*, a luxurious crossing can be made in a trifle over five days and a half. There are some interesting illustrations reproduced in the reprint.

Even as I write I notice another improvement in the Atlantic services of the company. The *Ionian* has been added to the division of the fleet which sails from Glasgow, whilst her place in the Liverpool service has been filled by the new *Corsican*, a twin-screw liner of 11,000 tons, fitted with the latest luxuries which the experience of the company can provide. I have said that the *Corsican* is a twin-screw. For the particular work for which she is designed high speed was not essential, and accordingly she has reciprocating engines, it being admitted on all hands that, save for express steamers, the turbine system, as at present applied, is not desirable. A time will come, no doubt, when it can be used for tramps and mixed cargo and passenger vessels. But that time is not now. Meanwhile the fact that the *Corsican* is engined, as I have said, is not to be taken as in anyway indicating a weakening of the faith which the Allan line has shown in Mr. Parsons' invention.

Changes in the Fleets.

The City of Dublin Company was assuredly one of the last of the fleets of the narrow seas—save, of course, the Dutch Zeeland Company, which seems conservative beyond all others—to continue its adherence to the paddle type of steamship. Assuredly, too, the old Holyhead mail steamers of the Dublin Company were by far the most famous ships of their fast-disappearing type. Yet the City of Dublin Company can already boast that it has no longer any of these obsolete vessels in its list. This position has been reached by the recent sale of the company's steamship *Galway*, which was built as recently as the year 1891 for their Liverpool and Dublin service by the Port Glasgow firm of Messrs. Blackwood & Gordon.

The Union-Castle Company have for some time had two reserve mail steamships lying off Netley. These have been the *Dunottar Castle* and the *Dunvegan Castle*. Seeing the regularity and freedom from accident which characterize the working of the Company's mail service, it seems precaution drawn to absurdity to maintain two such vessels as a reserve, and, accordingly, opportunity having presented itself, the smaller of the two ships, the *Dunvegan Castle*, has been chartered to the Panama Railroad Company for service on the Atlantic side—that is to say, between New York and Panama. The charter is but for a year certain. But there is always a chance that ships that go away under such circumstances fail to return to their old trades.

The increases in the Pacific Steam Navigation Company's fleet are indeed remarkable, and the chairman was quite justified in attributing his desire to get out of the Australian business to the calls of the Company's legitimate business. Last year ten vessels were on order or in process of construction. Now there are five in that condition. But none of the five are remnants of the ten. So the total additions are fifteen bottoms in two years ! .Of the new list one is an important mail steamer, the twin-screw *Orcoma*, to come from the Beardmore yard, and the remainder are cargo boats, two of which are to come from this yard and the other two from Clydebank.

The P. & O. Company has on order a new twin-screw liner from Messrs. Caird & Co. She is to be a new *Isis*, but of 6000 tons instead of under 2000 tons, and is for the Bombay and Aden route instead of the trans-Mediterranean. Her speed will be about equal to theirs, and her accommodation far in excess of anything they can offer, whilst her sea-keeping qualities will enable them to meet the Indian Ocean monsoons with equanimity and an even keel. She will come in anticipation of the new Post Office contract.

The News of the Month

has, however, been the announcement by the directors of Messrs. John Brown & Company that they have acquired a substantial interest in the business of Messrs. Harland and Wolff, of Belfast. What exactly this means we cannot yet discover. But certain facts are known to us all. Messrs. John Brown & Co. are a limited company whose securities are freely dealt in on the London Stock Exchange and elsewhere. Their business is to a large extent, therefore, public property. The other firm, though it has of recent years taken advantage of the Limited Liability Acts, is really a private concern and issues no reports or balance sheet. But we do know this, that shipbuilding is by no means the whole of the Clydebank business. They are ironmasters and makers of great steel forgings, and of those things which go towards the construction of the warships of the present day.

Messrs. Harland & Wolff, on the other hand, have ever kept themselves apart from their fellows and have devoted themselves absolutely to the construction of merchant steamships of large size and of a certain type, though, of course, of a type subject to considerable modifications in individual cases. They have their standard type of engine, their well-known form of ship. Their methods of plating and even of arranging their accommodation is known to all those who see modern steamships. Outside their beaten track they have seldom ventured, save occasionally to build a set of engines for the Admiralty. Their connection with Messrs. John Brown will put them in a position to obtain armour and forgings at prices which will make it worth their while to widen their sphere of business.

So much on the one side. Then on the other we must not

forget that they have a remarkable asset in their connection with the International Mercantile Marine Navigation Company, whose report recently issued shows signs of returning prosperity and of an intention to build largely, now that ability to do so seems in a fair way to be assured. Messrs. John Brown & Company will secure their share of this important work. One must not forget, finally, in regard to this amalgamation of interests, the position of the new Southampton yard. The capital which Messrs. John Brown are finding for the Belfast firm will no doubt go at least in part to the development of this yard, and it would not be surprising to me to see this attain something more than the position of a mere repairing place for the Southampton steamers of the Combine. But this development must largely depend on the way in which the port of Southampton and the London and South-Western Railway meet the stranger who is coming within their gates.

THE SCREW PROPELLER.

XII.*

By A. E. Seaton, M.I.C.E., M.I.N.A., M.I.M.E., Etc.

ALTHOUGH no further special experiments appear to have been made by the Admiralty, after the trials of the *Archer*, with the object of arriving at any decision as to the best diameter of screw proper for ships of certain engine power and desired speed, ships were tried from time to time with changes of propeller, and in some few instances the difference in diameter was sufficiently marked to enable us now to make general deductions from the trials, as to the effect of increase or decrease in that dimension. Knowing now the very great importance of having that diameter of screw which is best suited to the form of the ship and the engines driving it, our regret must be great that out of the huge sums spent on the fuel used in H.M. Navy, a few thousand pounds were not spared to experimentally discover all that was necessary to be known for the design of the propeller, or at any rate to have made such elementary investigations as would have resulted in preventing the fitting of scores of unsuitable screws, whereby ships either steamed about the world at a knot or two slower speed than they need have done, while others did their best speed with 30 to 50 per cent. more horse power than was really necessary; consequently, it was not until 1877 that it was found how very serious the matter was, when by a change of screw in H.M.S. *Iris*, a speed of 18·58 knots could be obtained with the same power that was required with her original screw for only 16·5 knots.

The Professors of Science of the time had demonstrated, theoretically, that large diameter meant high efficiency; but the early screw steamers were of comparatively light draught, and twin screws had not been thought of; consequently, there were no steamships with what may be considered absurdly large screws, except, perhaps, the *Archer*.

When, however, larger and deeper ships were built, the "largest diameter possible" rule led to more serious mistakes in that direction, inasmuch as ships of the same draught of water had about the same diameter of screw, whether the N.H.P. was 200 or 600, or the speed 9 knots or 12.

At this date it is, of course, practically impossible to state with certainty why such inconsistency prevailed in a department where the issues were so serious, nor is it easy to understand why, when so many and costly experiments were made by the Admiralty from 1845-1865 to determine the relative values of propellers of different shapes, different number of blades and different pitches, none seem to have been devoted to ascertain the most effective diameter. It is true, however, that on the early trials of certain ships a smaller screw was fitted than the one eventually used on service; such instances were, however, few, but of them the following have been selected as affording data on which to form an opinion of the relative merits of the different diameters.

The *Industry* was a store ship of 1122 tons displacement, and in 1856 was tried with a screw 9 feet diameter and 11·5 feet pitch, having a surface of blades 31·2 square feet; a speed of 7·3 knots was obtained on 266 I.H.P., the Admiralty coefficient being 160·5. Later on a screw of 10·1 diameter, with a pitch of 14 feet and surface of blades 37·3, was fitted, and on the trial of the ship the speed was only 7·14, with an I.H.P. of 244, the Admiralty coefficient being 159·3.

In these two trials it will be seen that owing to the difference in revolutions, the screw friction was practically the same in both cases, and that the general efficiency, namely, $\frac{\text{K.H.P.}}{\text{I.H.P.}}$ was also practically the same. The H.P. delivered by the larger screw was considerably in excess of that delivered by the smaller, but the propelling efficiency of the smaller screw compared with that of the larger as 376 to 291, all these things pointing to the smaller screw as being a better propelling instrument.

In 1857, H.M.S. *Flying Fish*, the ship to which a false bow was fitted, as already described on page 326, was tried with a screw 11 feet diameter, 21·3 feet pitch, and having 41·2 square feet surface of blades, the speed obtained on the measured mile being 11·298 knots, with an I.H.P. of 1155, the Admiralty coefficient being only 129·7. A few months later she was tried again with a common screw 13·2 feet diameter and 20 feet pitch, having a blade surface of 56·4 square feet, which it will be noted is considerably in excess of that of the smaller screw. The speed obtained was 11·736 knots with 1167 H.P., or practically the same as before, the Admiralty coefficient being now 143·1. In this case the general efficiency was 0·411 with the larger screw as against 0·371 with the smaller; the H.P. delivered by the smaller screw was considerably less than that by the larger, and the loss by screw friction was more than 50% greater with the larger screw than the smaller. It would appear also from this trial that the engine efficiency, probably due to the higher revolutions, was much less with the smaller screw than the larger. In this case also, as a propelling instrument divested of everything else, the smaller screw appears to have been the better by 279 to 229. It is, however, very possible that a 12-feet screw may have been better still for this particular ship, the jump from 11 feet to 13 feet being too great to come to a satisfactory conclusion, even if the pitch ratio had been less.

In 1857-8, H.M. Frigates *Doris* and *Diadem*, sister ships, were built; they were 240 feet long, 48 feet beam, and had a mean draught of water 20·5 feet; their displacements were about 3800 tons and their wetted sinks about 16,400 square feet. The *Diadem* was

* For Articles I. to XI. see August to June issues

slightly finer than the *Doris*, her prismatic coefficient being 0·739, while that of the *Doris* was 0·743. The *Diadem* engines were by Maudslay, having two cylinders 82 ins. diameter and 48 ins. stroke, while those of the engines of the *Doris*, by John Penn and Son, were equal to 82 ins. diameter and 48 ins. stroke. Each had a propeller 18 feet diameter, that of the *Doris* being 32 feet pitch and that of the *Diadem* 33·5 feet, the blade surface in both cases being 80 square feet.

In 1859 the *Doris* was fitted with a propeller 20·1 feet diameter and 31·95 feet pitch, with a blade surface of 105 square feet. It will be seen by referring to Table XIX. that with this propeller the same speed was obtained as with the smaller one, but with 133 less H.P., thus saving nearly 5 %; the Admiralty coefficient was 142 against 136·6, and general efficiency was 0·365 against 0·350 with the smaller screw. The *Diadem*, however, did 11·66 knots as against 11·82 of the *Doris* with only 2326 I.H.P.; the Admiralty

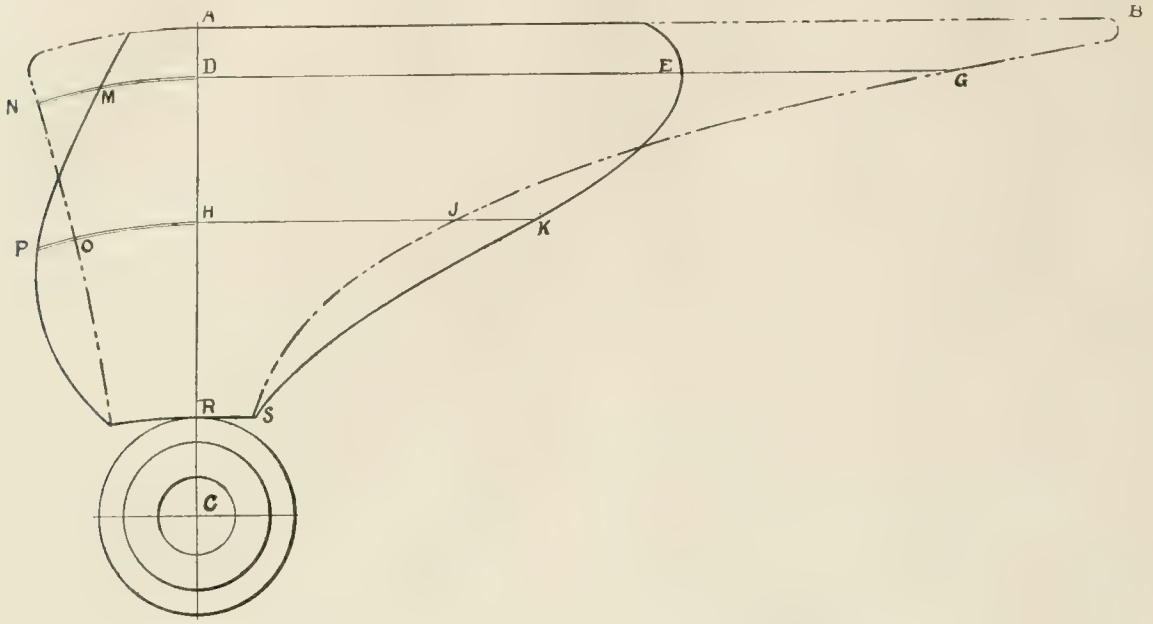


Fig. XXI. Friction H.P. of blades of same area but different shapes.

TABLE XIX.

TRIALS OF H.M.S. WITH SCREWS OF DIFFERENT DIAMETERS, COMMON SCREWS.

	H.M.S INDUSTRY, 1856.		H.M.S FLYING FISH, 1857		H.M.S DORIS, 1859		H.M.S. DIADEM, 1858.
	Old Screw.	New Screw.	Old Screw.	New Screw.	Old Screw.	New Screw.	
Diameter of Screw .....ft.	9·0	10·1	11·0	13·2	18·0	20·1	18·0
Pitch do. do. .....ft.	11·5	14·0	21·3	20·0	32·0	31·9	33·5
Surface of Blades.....sq. ft.	31·2	37·3	41·2	56·4	80·0	105·0	80·0
Pitch Ratio	1·280	1·400	1·936	1·515	1·778	1·597	1·861
Slip per cent.....	23·04	27·69	32·46	20·51	29·66	22·15	27·43
Revolutions per minute	83·60	71·42	79·5	75·0	53·25	48·25	48·75
Speed of Ship .....knots	7·30	7·14	11·298	11·736	11·823	11·826	11·661
Indicated Horse Power	262	244	1155	1167	2917	2784	2326
Do. Thrust..... lbs.	9000	8050	22500	25670	56500	59900	47000
Calculated Thrust ..... ,,	5000	6100	15450	20280	38100	42550	34720
Resistance of Ship ..... ,,	4250	4080	12370	13330	27900	27980	27200
Augmented Resistance ..... ,,	750	2020	3080	6950	10200	14870	7520
Resistance Ship (H.P.)	94·9	89·4	428	480	1014	1017	979
Screw Friction do.	16·9	16·4	44·6	69·6	108·4	151·0	85·5
Engine Losses do.	133·1	94·0	576	367	1425	1087	991
Horse Power delivered by Screw	112·0	133·7	536	730	1384	1546	1249
Displacement $^{2/3}$ × Speed^3 ÷ I.H.P.	160·5	159·3	129·7	143·1	136·6	142·2	163·8
Do. do. do. ÷ P.H.P.	376	291	279	229	288	256	307
General Efficiency R.H.P. ÷ I.H.P.	0·362	0·367	0·371	0·411	0·350	0·365	0·420
Engine do. P.H.P. ÷ I.H.P.	0·492	0·615	0·503	0·685	0·511	0·610	0·574

coefficient being in her case 163·8, the difference being no doubt due to the higher efficiency of the machinery of the *Diadem*, for the *Doris* at half-boiler power, with a speed of 10 knots, still had a coefficient of only 145, which is very low.

For the same machinery, under fixed conditions of revolution and power, it is, of course, obvious that there must be one particular screw whose diameter, pitch, and surface is the best, that is, such as to give the highest efficiency; but there may be other screws having a very considerable number of variations in these particulars which will produce results varying, but not largely, from that of the best screw. Of these various screws, there will be one, or perhaps two or three, that will suit a particular ship, and give the highest general efficiency; if, however, with the same machinery in a ship of different form that particular screw is tried, the results will very likely prove at least disappointing. It will be remembered that it was the success of a particular screw in *H.M.S. Himalaya* that induced Sir James Wright to try a repeat of it in *H.M.S. Iris*. In that case it was apparently the diameter chiefly at fault, Sir James having evidently overlooked the fact that the one ship was twin-screw, while the other had only a single screw.

The diameter of a screw propeller may be deduced from the equation given on page 280, but if in practice this rule were followed the *Iris* mistake might be repeated. As a matter of fact, in every-day practice a considerable amount of discretion has to be exercised in fixing on the diameter to suit a particular ship, rather than to follow any fixed rules, empiric or scientific; at the same time a considerable amount of guidance may be afforded by using formulæ based on theory, but modified by the teachings of practice. We know that the better the propeller is supplied with water the smaller it may be; hence it is that the fine ship can be propelled by the same machinery with a propeller of smaller diameter than that of the bluff cargo boat. We have also reason to believe that the superior efficiency of the twin-screw ship is due to the propellers acting in less disturbed water than usual with the single screw, and consequently they are better supplied with water. So it will be also with such ships as the *Lusitania*, having four screws. These, in spite of the small diameter necessitated by being driven by turbines, may still have a fairly high efficiency.

The effect on the output horse power of a screw by an increase or decrease in diameter can be seen by reference to Fig. xxi., where the resistance of the blade of a common screw is shown with that of a Griffiths propeller of the same surface. The curve B.G.J.S. is formed by the ordinates D.G., H.S., etc., which represent the resistance of the narrow elemental strips $2 \times$ N.D., $2 \times$ O.H., etc., multiplied by the space moved through by them. In the same way with the elemental strips of the Griffiths screw the curve E.K.S. is formed by the ordinates D.E., H.K., etc., which represent the resistance multiplied by the space. Altogether, then, the figure A.B.S.R. represents the total work absorbed in overcoming the resistance of the blade of the common propeller, and the area A.E.K.S.R. represents the total work in overcoming the resistance of the Griffiths blade at the same revolution. It will be seen then that if both propellers are cut off at the point D, so that half the diameter is C.D. instead of C.A., the area A.B.G.D. represents the saving in power with a blade of the common screw, and the area A.E.D. the saving of power with the Griffiths so treated. If instead of reducing the blade by A.D. it had been increased by that amount, it will be seen that the increased resistance with the common screw would have been very large, while that of the Griffiths would have been comparatively small.

The Denny Gold Medal has been awarded to Mr. Jas. Adamson, Hon. Secretary, for his paper read before the Institute of Marine Engineers last October, under the presidency of the Right Hon. Lord Pirrie, and entitled "The Advantages of a Technical Society."

Institute of Marine Engineers.—The next Saturday afternoon visit arranged for in connection with this Institute is to the Great Eastern Railway Works, Stratford, on July 13th. Admission is by card, which may be obtained on application by members.

Mr. Hislop, Secretary, Australasian Institute of Marine Engineers, is now on his way back to New Zealand after sojourning in Britain for a few weeks on the termination of the Maritime Congress, at which he sat as the representative of the engineers of Australasia. The best wishes of many friends who have met them during their visit to the home-country accompany Mr. and Mrs. Hislop on their return voyage, and the hope has been expressed that the mutual expressions of goodwill and fellowship may be treasured and preserved both at home and abroad. One very pleasing feature in connection with the Congress has been particularly noticeable, the excellent relationship existing between the steamship owner and the engineers in the colonies.

Merchant Seamen's Orphanage.—The fourteenth annual excursion in connection with the Merchant Seamen's Orphanage is arranged for Wednesday, July 3rd. The General Steam Navigation Co.'s *Oriole* has been placed at the service of the committee, and the programme for the day is a tempting one. Leaving London Bridge at 10 a.m., a call is made at Tilbury about 11.30, and then a run is made to taste the sea breeze for a few hours, returning to Tilbury at about 7 p.m. for train back to London. The tickets are 10s. each (ladies or gentlemen), including luncheon on board and railway ticket from Tilbury to Fenchurch Street, and can be obtained at the office of the Orphanage, Dixon House, Dixon Avenue, E.C. It is hoped that the funds will be benefited on this day, as on former similar occasions.

The strike at the works of Messrs. Vickers, Sons & Maxim, Erith, is one of those unhappy and unfortunate events which every one must deplore, no matter what view may be entertained of the supposed rights or wrongs of the case. It is a barbarous method of bringing about a settlement of any question. The incident is an unhappy one for all hands and those who are dependent upon them—for both employers and employed; it is unfortunate for the country at large, giving an opportunity for competitors and rivals in trade to take advantage of. It is not within our province to discuss the details of the strike or the causes leading to it, but in the interests of our home trade generally, the event comes before us as an object lesson and an illustration of one of the undesirable things which ought to be prevented. It has been said that it is not possible to make a man sober by Act of Parliament, but at the same time temperance reformers have accomplished much, and these outbreaks we have from time to time appear to be simply another form of intemperance, a kind of moral earthquake dealing out ashes of destruction upon sections of the community and necessarily affecting the common good. There is room for a reformer if legislation cannot cope with the madness of strikes.

ON THE USE OF HYDRAULIC RIVETING IN THE CONSTRUCTION OF THE "MAURETANIA."*

By E. W. DE RUSETT, Esq., Member.

AS one of the most important factors in the construction of a steam vessel is the riveting—and especially so in vessels of such dimensions and power as the *Mauretania* and her sister vessel, *Lusitania*—it was determined to resort to hydraulic riveting to a much larger extent than usual, primarily on account of the thickness of the plates, $\frac{23}{32}$ in., and the length and large size of the rivets. This decision was come to after duly considering the effect of hydraulic riveting on the progress of the work, and it was considered advisable to extend it to the following parts of the structure, *viz.*:—the keel plates, centre keelson, garboard strake, and shell plates within the range of the double bottom, also the connection of shell to stem and stern castings, floors, frame bottoms and top bars, tank girders, web frames, reverse bars to frames and tank side knees, and also the girders forming the engine seating.

Fig 1

PROFILE SHOWING EXTENT OF HIGH TENSILE STEEL AND HYDRAULIC RIVETTING OF TOP SIDES.

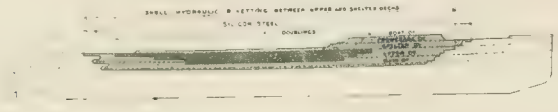
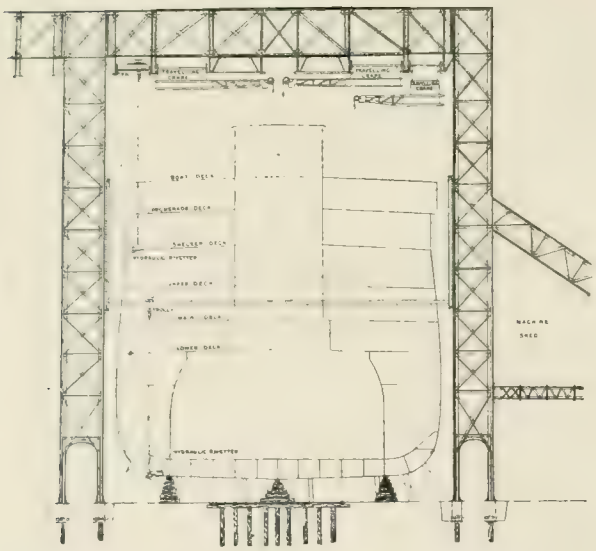


Fig 2.

O T S S MAURETANIA IN SHIPBUILDING SHED SHOWING ARRANGEMENTS FOR SUSPENDING AND TRANSPORTING BY HYDRAULIC RIVETTERS



The topside plating and doublings are also hydraulically riveted for a length of about 520 ft. amidships, and the shelter deck stringer and doublings for a length of about 440 ft., as shown in Fig. 1.

The seams of the bottom shell plating of the vessel, where hydraulic riveting was resorted to, are arranged clincher fashion, so that the machines could close the work strake by strake. The frame bottoms are joggled. The bottom shell butts are double strapped, the inner strap having three rows of rivets, two of which are close pitched, the outer row being wider spaced. The outer strap is double riveted, with edges bevelled to reduce resistance. The keel is formed of three plates, the middle piece being $\frac{1}{16}$th thicker than the garboards to allow of their being placed in position after the keel plates and longitudinal keelson bars were riveted. The butts of the keel plate are not strapped, as it was found there would be sufficient margin of strength without doing this. By the omission of these straps about $\frac{3}{4}$ in. of draught was saved. This was of great importance, considering the small margin of deadweight that it is possible to obtain in a vessel of this character on the given maximum draught of water.

The plating of the topside, where the doublings occurred, had to be so arranged that the inner edge of the landing was kept at the top, so that each plate could be riveted up in due order. This will be observed by reference to Figs. 3 and 4.

The eight hydraulic riveting machines employed were of three sizes, having gaps 5 ft., 5 ft. 6 in. and 6 ft. respectively. The 5 ft. 6 in. gap machines were found to be the most serviceable for general purposes. They were each fitted with an adjustable arrangement by which the pressure could be brought to bear directly through the axis of the rivet at whatever angle the plating lay, the result being that very little trouble was experienced in pressing the rivets fairly into the countersink. The machines were supported by trolleys running in the roof of the shed under which the vessel was built, also from derricks which were guyed from the standards of the shed, as shown in Fig. 2, the trolleys and derricks being so arranged that they could be readily moved to any required position within their range of action. The shell rivets called for very careful consideration, both as regards the convexity of the head and taper of the neck and their length in proportion to the thickness of the plates they connected.

Fig 3

SHOWING EXTENT OF HIGH TENSILE STEEL ON DECKS AND TOP SIDES

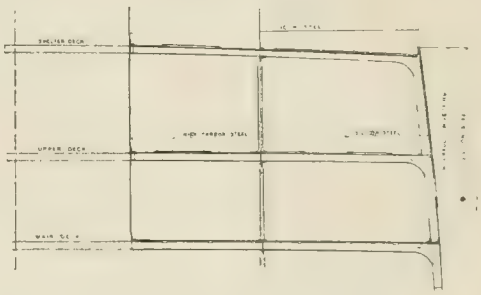


Fig 4

SHOWING ARRANGEMENT OF SEAMS OF TOPSIDE PLATING TO SUIT HYDRAULIC RIVETTING AND CONNECTIONS OF PLATING AND DOUBLINGS

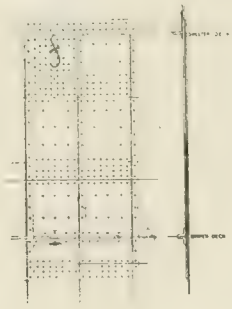
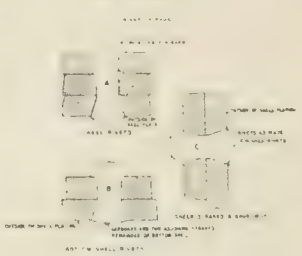


Fig 5

SHOWING COUNTERSINK OF RIVET HOLES IN SHELL BEVEL OF RIVETS AND FULLNESS OF POINTS



The proper relation of the bevel of the countersink to that of the neck of the rivet was a matter of much importance, otherwise a sound water-tight job could not be readily obtained. And, further to ensure good work, any burr left on the edge of the countersink rivet head during manufacture was ground off. Fig. 5 shows the bevel of the countersink in the shell for neck and point of rivet, also the bevel of the neck of the rivet before being closed up. It is worthy of remark that it was found by experience that the bevel of the rivet neck had to be less than that in the plate to ensure good closing, otherwise the material did not solidly fill the hole from the root. The angles of these bevels are, for the

* Read at the Bordeaux International Congress and Summer Meetings of the Forty-eighth Session of the Institution of Naval Architects June 27, 1907.

neck of the rivet 18½ deg., and for the plate 20 deg., each measured from the axis of the rivet. The proper length of the shell rivets was a matter of experiment, as the rule for hand-laid rivets did not apply on account of the great pressure employed in closing them, which amounted to about 50 tons.

By reference to Figs. A, B, C (Fig. 5), it will be observed that the heads of the rivets in the keel were made fuller than those in the garboards and three adjoining strakes, while further up the bilge the heads were finished with only the usual amount of fulness to afford as little resistance to the water as possible. The countersunk rivets in the bottom, shown at A and B, were put in from the underside and clenched on the inside, and those on the topsides C were also clenched on the inside the heads being rounded as shown in the diagram. The deck rivets were countersunk and flush on the top on account of the deck sheathing, and clenched on the underside.

Mild ingot steel was employed for all the rivets at the strong recommendation of the authorities of Lloyd's Register from their experience up to date. The rivet rods were therefore specified to have a tensile strength of from 26 to 30 tons with an elongation of not less than 20 per cent., and an elastic limit of from 13 to 15 tons. The rivets are of 1⅛ in. diameter, and are spaced to give an area at least equal to the requirements of Lloyd's rules for mild steel plates of equivalent strength to the high tensile steel used. Under ordinary conditions of riveting by hand this area might be questioned on account of mild steel rivets being employed for the connection of hard steel plates, but it was considered that the hardening effect produced on the rivet by a hydraulic pressure of 50 tons overcame this objection, and also through the increased efficiency of the riveting and the fact that the sharp edges of the holes in the plates were removed, as shown in Fig. 5, by a special tool.

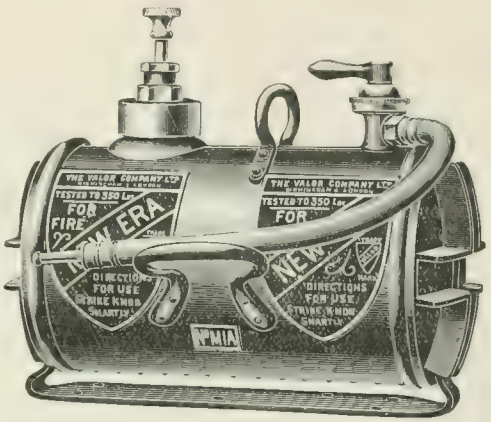
Upwards of four million rivets were used weighing fully [illegible] tons a considerable proportion of which are hydraulically riveted. They were heated in oil furnaces, specially designed at the Wallsend Yard. Each furnace has a daily heating capacity of at least 3000 rivets, 7 by 3 in. About eleven gallons of crude oil were consumed in each furnace per day. The oil is disintegrated by air drawn from the mains supplying the pneumatic tools. These furnaces may be readily regulated to work absolutely without smell or smoke, and they heat the rivets in a clear white flame.

Dr. Elgar on Tuesday evening, June 18th, delivered a lecture on "Unsolved problems in design and propulsion of ships," before the Institution of Civil Engineers, Great George Street, Westminster. The meeting was a special one, called to hear the fourteenth annual "James Forrest" lecture—inaugurated to commemorate the name of one who, still hale and hearty, continues to take a keen interest in the affairs of the Institution. The lecturer gave an outline of the various problems which have occupied the attention of naval architects and marine engineers—form and strength, size and stability of hull, loading of cargoes, distribution of weight, safety and comfort of passengers—reference being made to the reduction in the losses of ships and of lives during recent years—vibration, speed, machinery of reciprocating and turbine type, the possibilities of the gas engine. The luxurious provision made for the traveller of to-day was commented upon, as were also the attempts made to overcome the tendency to discomfort caused to the passenger, made timorous by the rolling and pitching motions. A model was shown to illustrate the efficacy of an arrangement of the Gyroscope to minimise rolling. This was described by Sir Wm. H. White at the close of the lecture, and it was shown in action proving to the audience that the effect was all that the designer claimed. In proposing a vote of thanks, Sir Wolff Barry remarked upon the design and work of Brunel in connection with the *Great Eastern* and the problems of ship construction, and of Froude in connection with propulsion and the problem of the screw propeller. In seconding the vote, Sir Wm. Preece narrated his experiences of crossing the Atlantic, contrasting the bill of fare and the appointments of the saloon and cabins of thirty years ago with those of to-day, the third-class of now being almost, if not quite equal to the first-class of former days when he made his first voyage across. The vote of thanks was heartily accorded to Dr. Elgar.

"NEW ERA" PETROL FIRE EXTINGUISHER.

THE wide use of petrol at the present time has much increased the risk of danger to life and property from fire, and the responsibility in this matter has been brought home, in many instances, to those liable, in a somewhat unpleasant manner.

To meet the variety of circumstances under which such risks may arise, the Valor Company, Ltd., of Rocky Lane, Aston Cross, Birmingham, and 9, Bush Lane, Cannon Street, London, E.C., have put some special types of the chemical fire extinguisher on the market.



We have pleasure in illustrating, in the adjoining representation, one of their horizontal pattern extinguishers, provided with patented cross-channel ends, which permit a spring bracket to be fixed on the back or side of a boat, and at the same time ensures the retention of the extinguisher in an upright position, and to be always ready for use by simply striking the knob on the left side and directing the stream upon the seat of the fire. The container is made of sheet steel, lined with lead, to prevent corrosion, and is tested to 350 lbs. per square inch.

They have just been favoured with an order from the Italian Government to fit this type to all their submarines.

Steel Forgings.—Mr. Alfred Brown, of Barrow-in-Furness, the general representative in this country of the Bochumer Verein Steel Company, of Bochum, Westphalia, has sent us a descriptive catalogue dealing with this company's works and their products. It is interesting to note that the annual output of steel is 400,000 tons, and includes solid and hollow crank and propeller shafts, built-up crank shafts and steel forgings of every description for marine, electrical and general engineering. These works employ no less than 12,000 hands and have a turnover of £2,600,000.

The Skoda Works, Pilsen, Limited.—The representative of the Skoda Works, Pilsen, Limited, Bohemia, who is Mr. Alfred Brown, of Barrow-in-Furness, has sent us a descriptive catalogue of steel castings for shipbuilders, marine, electrical, hydraulic and general engineering, it also contains some excellent views of the works themselves from which one can gather an excellent idea of their extensive character. These works employ 3500 hands and have a monthly output of 12,000 tons. The Skoda steel is so well known as to need no special reference here, but it may be mentioned that the catalogue contains illustrations of steel castings for many British undertakings, as well as of work for most of the foreign countries where steel castings or forgings are in request.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondents.)

Portsmouth Dockyard.

THE King and Queen of Denmark, when they arrived here in the *Victoria and Albert* on June 8th, were received by the Channel Fleet at Spithead. It was a splendid sight. The fleet was in two lines, dressed over all with the Danish ensign flying at the main, the flagships *King Edward VII.* and *Hibernia* being at the eastern end of each line. Their Majesties left again on the 14th. The reports as to the *Dreadnought* have been very much exaggerated, and it was necessary for Mr. Robertson to explain the matter in the House of Commons. He stated that the damage was confined to the plating of the port rudder. This plating became partly detached owing to the loosening of some of the rivets and in consequence some of the wood filling pieces were lost. The main castings of the rudder itself were not impaired. The vessel left on the 18th to join the battle squadron of the Nore division of the Home Fleet for a cruise to Norway. She will return here about the end of July. A commission of six French naval officers paid a visit to the vessel at the end of May. They were received by Captain Bacon, who, it may be mentioned, goes to the Admiralty in August as Director of Naval Ordnance and Torpedoes. I hear that he will be succeeded in command of the *Dreadnought* by Captain Madden, who is at present naval adviser to the Admiral of the Fleet, Sir John Fisher. The visitors afterwards inspected the *Bellerophon*, which is to be launched on July 27th, Princess Henry of Battenberg having consented to perform the naming ceremony. The tonnage of the vessel will be 18,600, as compared with the *Dreadnought's* 17,900. Her indicated horse-power, however, will be the same. The *Bellerophon* will have a heavier secondary armament, and 4-inch quick-firing guns are to be installed. This gun is considered the ideal anti-torpedo gun. It is very gratifying to be commended when work is well done. Admiral Lord Charles Beresford, Commander-in-Chief of the Channel Fleet, has expressed his extreme satisfaction with the state of both the battleship *King Edward VII.* and the despatch vessel, *Surprise*, which were refitted here. Vice-Admiral Sir Assheton Curzon-Howe, Commander-in-Chief of the Atlantic Fleet, has also expressed by letter to Admiral Sir Day Bosanquet his appreciation of the manner in which his flagship, the battleship *Exmouth*, was refitted. At Admiral Curzon-Howe's request, Sir Day Bosanquet communicated the contents of the letters to Rear-Admiral Robinson, the admiral superintendent, and the officers of the yard. These compliments are much appreciated. The destroyer *Wear* has had her repairs completed and has rejoined the Nore Flotilla. The departure of the cruiser *Thames* and six "C" submarines for the Nore marks an important stage in the development of the submarine. Until quite recently all the submarines were at this port, where, under the direction of Captain Bacon, of the *Dreadnought*, the officers and men who now compose the specialists for submarines were trained. Devonport has now got a flotilla, as has also the Nore. At this port, Haslar Creek and Blockhouse Fort, with the hulk *Dolphin*, are to form the depot, and the cruiser *Bonaventure* is to be the sea-going depot. The present depot ship, the *Mercury*, will, it is understood, go to Dover. Progress is being made with the development of Haslar Creek for the use of submarines. Ferro-concrete piles have been driven down, and when the further dredging now in hand has been completed, the floating dock is to be taken there and secured between the piles. The floating dock has been for several months lying in one of the large basins. A sad accident, due to an explosion of gasolene, took place on board Submarine "C 8" on June 13th, by which Lieutenant Commander Guy Hart lost his life and two seamen were injured. The vessel was not damaged in any way. Captain Tate, captain of the yard and King's harbourmaster, leaves us on July 1st on reaching flag rank. He will be succeeded by Captain Tottenham, of the battleship *Mars*, at Devonport.

Devonport Dockyard.

It has now been definitely decided that the battleship *Téméraire* is to be launched on August 24th, but it is not yet known who the lady will be who is to perform the naming ceremony. The vessel will have been in hand three months longer than the *Dreadnought*, but that vessel was built under conditions of abnormal pressure, and it must be borne in mind that she is nearly eight hundred tons smaller than our ship. The *Dreadnought*, too, was not nearly so far advanced as the *Téméraire* will be when she leaves the slip. Hitherto, the dates fixed for the completion of new vessels and those undergoing large refits have not always been strictly adhered to. The admiral superintendent has therefore issued an order in which he states that the "date for completion" is to be interpreted as the date on which the ship can proceed to sea, so far as the dockyard is concerned. The new cruiser, *Indomitable* has been allotted to this port and will arrive from the Clyde to be commissioned for the Home Fleet about the end of September. The *Minotaur*, which was launched twelve months ago, is to be fitted as a flagship. She will also, I understand, join the Home Fleet. We have had quite a number of distinguished visitors, among them being Admiral Sir William May, the Second Naval Lord; Inspector-General Ellis, Medical Director General of the Navy; Mr. Marshall, the Director of Dockyards, and Professor Ewing, the Director of Naval Education. Lord Charles Beresford came round in the despatch vessel *Surprise*, accompanied by Lady Beresford. There were three vessels of the Channel Fleet here, the *Commonwealth*, *Vengeance* and *New Zealand*. His lordship visited the ships and made a close inspection of the *Commonwealth*, especially of those parts damaged in her collision with the *Albemarle*. The two former vessels have now left to rejoin the fleet for its summer cruise. The *Commonwealth* did a remarkably good coaling performance before leaving. With an entirely new crew she averaged 156½ tons per hour, the total amount placed on board being 1600 tons. The *New Zealand* is still here at the time of writing. Advantage is being taken of her stay in dock to instal the latest type of high-power wireless apparatus for long-distance work. Her net defence is also being overhauled. The cruiser *Cornwall* has been supplied with the latest pattern twin telescopic sights to each of her fourteen six-inch guns, and is now in dock having the accuracy of their fitting tested. Another vessel of the Home Fleet in hand is the cruiser *Europa*, which is having fire-control fittings installed. These have proved such a success in battleships and armoured cruisers that it has been decided to extend their use to cruisers of the *Diadem* class to which the *Europa* belongs. The *Onyx* has been towed to Portsmouth to be fitted as a base for our submarine flotilla. She is a gunboat of the type at first called torpedo boat catchers, and was built by Laird's, at Birkenhead, in 1892. The cruiser *Warrior* arrived from Pembroke on the 14th and a week later proceeded to Portsmouth. The most important operation was the shipping of her net defence, and she was also completed with electrical and other stores and equipment. The *Aquarius*, which has been fitted up at Pembroke as a repair ship and distilling vessel, has arrived and has been commissioned for service with the destroyer flotillas of the Home Fleet. We have had a visit from a Chilian warship, the cruiser *Ministro Zenteno*, which arrived on the 15th and stayed nearly a fortnight. She is a vessel of 3600 tons, and with an indicated horse power of 7000 forced draught can do twenty knots. She was launched at Elswick in February, 1896. Happily the mishap to Torpedo Boat No. 99 was not attended with loss of life. On the 19th, she went out with four other boats for a quarterly steam trial, and when off Berry Head her stern shaft snapped. Fortunately, the torpedo gunboat *Dryad* was close at hand, for she sank a few minutes after the crew were taken off by that vessel. Arrangements are being made with a salvage company to raise her. The Lords of the Admiralty paid us an official visit on the 27th. As was the case last year, workmen's deputations were received in support of the annual petitions. I said last month that Engineer Captain Wishart, chief engineer at Malta, would probably come here when Mr. Andrews retires. The appointment is now officially announced, with effect from July 7th.

Chatham Dockyard.

The most important event of the month was, of course, the visit of the Japanese ships *Tsukuba* and *Chitose*. The

visit, which lasted a fortnight, was one round of festivities. The officers visited the naval establishments, a garden party was given in their honour at Admiralty House, they went to London and were entertained at the Admiralty, and the principal officers were presented to the King. The warrant officers were entertained by their confrères at the Naval Barracks, at the messes of the Royal Marines and Army Service Corps, and on board the *Hawke*, when they were presented with an illuminated address, in which high tribute was paid to the courage, patriotism and endurance of "our comrades in arms," and the hope expressed that the "peace of both hemispheres may be wisely and honourably maintained by the united efforts of our combined forces." The programme of entertainment for both officers and men fully sustained the reputation of the Navy for hospitality, and it was fully reciprocated by our allies. Before leaving for Kiel, Admiral Ijuin expressed his gratitude through the press for the reception, which he said "will not merely form a very pleasant souvenir of our visit to this country, but will also be highly appreciated by the whole of our nation." The overhaul of the cruiser *Sutlej* has turned out to be a bigger job than was expected, the engines having given considerable trouble. Only the most urgent work is being done; the other defects are to stand over until the vessel again visits the yard at the end of her next cruise. The alteration to the cruiser *Blenheim* to adapt her as a depot ship for destroyers are well in hand. The *Blake*, *Leander* and *Tyne* are to be similarly adapted, and extensive alterations are also to be made to the torpedo vessel *Vulcan*. The *Blake* is shortly expected from Devonport. While she is here her duties will be carried out by the *Leander*, the depot ship for destroyers at this port. The work of repairing the battleship *Dominion* has been completed and she has rejoined the Channel Fleet. About £30,000 was spent on her, two-thirds of which were for labour, but it was not all expended in making good the damage she sustained by grounding in the Gulf of St. Lawrence. Another battleship of the Channel Fleet, the *Triumph*, has arrived for her annual refit, and she is to be completed by July 20th. The *Antrim*, of the Second Cruiser Squadron, has also arrived for her annual refit. Workmen have commenced to break up the old unwieldy 110-ton guns, which have been lying here for some years. They formed part of the armament of the *Sans Pareil*, and were interesting, if only to show the immense improvement which has taken place in naval armament of recent years. Mr. Fell, the member for Yarmouth, has been inquiring in the House of Commons concerning Chatham, and has elicited from Mr. Robertson that the decrease in numbers here last year was 398 and up to June 1st this year there was a corresponding net increase of 251. Mr. Robertson also stated, "Representations in regard to the work to be allotted to this yard have been made to me by a large and influential deputation, introduced by my honourable friend, the member for Rochester, to whom I hope to be able to give an early reply." This was on June 13th, so probably we shall soon "hear of something to our advantage." Mr. J. Black, the chief constructor at this yard, retires in a few weeks' time, and he will, I hear, be succeeded by Mr. A. E. Richards, the constructive manager at Devonport. The new manager at Devonport will be Mr. H. Pledge, chief constructor at Gibraltar, who was formerly a constructor at the western port.

Sheerness Dockyard.

At the beginning of the month the Japanese cruisers, *Tsukuba*, flagship of Vice-Admiral Ijuin, and *Chitose* arrived. Admiral Sir Gerard Noel, the Commander-in-Chief at the Nore, came down from Chatham to greet the Japanese Commander-in-Chief, who went on board the *Undine* and paid his respects to Sir Gerard. That officer afterwards returned the compliment by paying a visit to the *Tsukuba*. It is quite likely that the two officers had met before when Admiral Noel was commander-in-chief of the China station. Rear-Admiral Finnis, of the Home Fleet, the captain superintendent, and the captains commanding the ships in harbour also visited the Japanese admiral. We had the unusual sight of seeing five admirals' flags flying in the harbour at one time. The flag of the Commander-in-Chief at the Nore was flying in the *Undine*, the flag of Admiral Ijuin in the *Tsukuba*, and Rear Admirals' flags in the *Bulwark*, of the Home Fleet, the *Leviathan*, of the Fifth Cruiser Squadron, and the *Illustrious*. The latter vessel had just completed her refit at Chatham, and was on her way to rejoin the Channel Fleet. The stay of the Japanese ships was very brief. It was thought that they would remain for four or five days, and arrangements had been made for entertaining the officers, but the vessels went on to Chatham the next day. They made a short stay when they returned, and the petty officers were entertained by the petty officers of the battleship *Majestic*. The cruiser *Thames* and submarines C1 to C6 have arrived from Portsmouth. The flotilla was originally intended to have been stationed at Dover, but the arrangements were cancelled a few months ago, and Harwich is to be its headquarters when it leaves here in a few weeks' time. With the Second and Fourth Destroyer Flotillas making Harwich or Felixstowe their principal head-quarters, those ports appear likely to have a good future before them. At one time there was only a coastguard ship at Harwich, but now there are training ships permanently stationed there in connection with the training establishment at Shotley and torpedo boat flotillas frequently put in there. The battleship division of the Home Fleet and four destroyers have proceeded on a cruise to Norway and the Fifth Cruiser Squadron has joined the Channel Fleet for a few weeks. About the middle of July, the vessels will return here, afterwards going on to Torbay, where the Nore, Portsmouth, and Devonport divisions of the Home Fleet are to assemble on July 22nd. The combined fleet, which is to be under the command of Vice-Admiral Bridgeman, will visit Bournemouth, Cowes and other places on the south coast, and will disperse on August 12th. Two of the vessels of the Nore division of the Home Fleet, the *Cochrane* and *Natal*, of the Fifth Cruiser Squadron, were selected for the honour of escorting the King and Queen of Denmark from Cherbourg to Portsmouth and back. This was no doubt for the purpose of showing His Majesty what our newest armoured cruisers were like. The harbour is now practically denuded of ships, but of course there are plenty up the Medway. The Home Fleet does not give us a great amount to do, but we are fairly well off for work. There are no big jobs in hand, with the exception of the conversion of the sloops *Rinaldo* and *Vestal*, but several small craft are engaging attention, while in the boiler and fitting shops work is being done for vessels building or re fitting at other yards.

Pembroke Dockyard.

The *Warrior* has now left us for good. She was commissioned on June 1st by Captain Waymouth and a crew which was brought round from Chatham in the cruiser *Donegal*. Five hundred and ninety tons of oil fuel were pumped into her on the 9th, this bringing the total weight of fuel placed in the ship to 2590 tons, including 1500 tons of coal and 500 tons of patent fuel. The inclining experiments were very satisfactory. They showed that a weight of one hundred tons placed twenty-five feet from either side of the ship caused her to be inclined about 3½ degrees from the normal position. The vessel left on the 14th for Devonport to ship ammunition and stores, and afterwards proceeded to Portsmouth to be docked for her guns to be sighted. The ship, however, is not yet completed outright. An alteration of the magazine ventilation will be made at either Portsmouth or Chatham, most probably the latter place, as will some other work that is incomplete, such as the electric-lighting arrangements. Apropos of the new order that ships are to be docked twice within the twelve months succeeding the date of being launched, there has been a rumour that the *Defence* is to be towed away, but it lacks confirmation. Messrs. Scott, the engineers, are making satisfactory progress, and the engine trials should take place about the end of the year, which will permit of the docking of the ship within eight months of her being launched. The towing of the ship away should therefore be unnecessary, and as the date of completion has been fixed for the end of next year, there is no reason for thinking that after her departure she will not return here, as has been rumoured. The electric power and lighting to be adopted in the vessel will be on an improved plan. Hitherto a current of 100 volts has been used, but in the *Defence* this has been raised to 220 volts, and instead of the power being transmitted from the generators through independent cables, two large cables will form a circuit from the s itchboard room through the ammunition passages and across the lobby at the fore end. From the large cables smaller ones will branch off to the various machines electrically driven, which

will include, for the first time in a ship built here, the fore capstan. This plan will considerably simplify the work of installation. The distilling and tank vessel *Aquarius* ran a very successful steam trial at the end of May and her electrical machinery also underwent a satisfactory trial. Then, having been subjected to inclining experiments, she left for Devonport. Material is accumulating for the new cruiser *Boadicea*, and this should permit of the ship being laid down at an early date. The hull will be of comparatively light construction and will not admit of a very large number of hands being employed on it advantageously for some time to come. The destroyer *Fawn* had to put into Pembroke to be dry docked, for she was leaking badly, and her pumps had to be kept going to keep her afloat. The mischief was caused by defects in one of the main inlets, which had to be replaced. Her defects having been made good, she left on June 9th for Lamlash to rejoin the First Destroyer Flotilla which was on a cruise. The Lords of the Admiralty arrived in the *Enchantress* on the 24th for their official inspection. Their Lordships also received deputations of the workmen in support of the annual petitions.

"ECLIPSE" STEAM SUCTION AND DELIVERY PUMP.

THE device illustrated in the adjoining diagrams is a steam suction and delivery pump of the ejector type. Fig. 1 shows it in its complete form, while Fig. 2 shows the three parts separated, of which it is composed, *viz.*, a body, a steam nozzle and an induction cone. It is made as a standard article

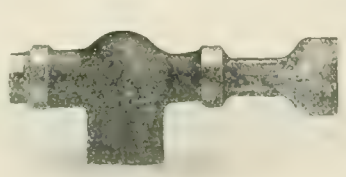


Fig. 1.

in five sizes, and with steam between 30 and 40 lbs. pressure, 20 ft. suction and 20 ft. delivery, that is, a total vertical distance of 40 ft.; the smallest size will deliver 700 gallons and the largest size 3500 gallons per hour, while the three intermediate sizes are 1000, 1500 and 2200 gallons respectively. It

Fig. 2.

follows that, with an increase in steam pressure, an increased delivery will be consequently effected. The pump is made in gun metal generally, but special metal can be used for special purposes. These pumps are made by Messrs. G. T. F. Harding & Co., of St. George's House, 82, Borough, London, S.E.

ELECTRICITY ON BOARD SHIP.

X*.

By SYDNEY F. WALKER, R.N., M.I.E.E., Assoc. M.I.C.E., Etc.

Distributing the Current.

The Single-Wire System.

THERE is a modification of the single-wire system, as mentioned in the last article, in which the ship is not used as a return. With this method what is known as a concentric cable is employed. In the concentric cable one conductor is formed in the usual way, by stranding wires together, six wires round a seventh, to form the seven series twelve wires round the seven to form the nineteen series, eighteen wires round the nineteen to form the thirty-seven series, as shown in the cablemakers' lists, and so on; and the second conductor is laid on outside of the insulation of the first conductor, and concentric with it, hence its name. The inner conductor is insulated just as if it was to be used as a single cable, the insulated envelope being generally a little thicker than it would be with a single cable. The insulation is protected by a layer of jute outside and sometimes with a braid, and the second conductor consists of a number of wires of such a size that they form together either one or two concentric layers, and also that their total cross section is the same as that of the inner conductor. Thus, if the inner conductor consists of nineteen No. 16 wires, laid up with seven wires round a central single wire, and twelve wires laid round the seven, the outer conductor may consist of nineteen wires laid in a single circle, or of any larger number of smaller wires, or smaller number of conductors of larger section, as convenient, provided that the total sectional area formed by the outer wires together is the same as that of the inner wires together. In some forms of concentric cable the outer conductor is made into a complete cylinder by forming the individual portions as sectors of a cylinder, or in special forms locking together, on the lines of the locked coil wire rope. The outer conductor is sometimes insulated and sometimes not. There are advantages and disadvantages in both methods. In the concentric system employed by Messrs. Denny, of Dumbarton, for wiring the ships they build the concentric cable is employed that was introduced some years ago by Messrs. Mavor and Coulson, of Glasgow, and is still used by them largely for mining work and for buildings. In Messrs. Mavor and Coulson's concentric cable the outer conductor is enclosed inside a lead tube, and sometimes the lead tube is also covered by a wire armour. In Messrs. Mavor & Coulson's and Messrs. Denny's practice the outer conductor consisting of the copper wires and the lead tube with which they are in contact are not insulated, and a whole line of fittings has been worked out to go with the concentric cable and uninsulated outer. The fittings are all arranged in metal cases, with which the lead covering of the cable is metallicly connected, so that the metallic cases form part of the return circuit, and the inner conductor is protected everywhere.

There is another system of concentric cables that was introduced some years ago, but which the writer believes is not much used at the present, in which the outer conductor consists of a number of galvanized iron wires, these being connected metallicly with metallic cases, etc., in a similar manner to Messrs. Mavor & Coulson's system. The great objection to galvanized iron outers, as marine engineers will hardly need reminding, is the probability of the wires being eaten away by salt water, and even where they are in positions where salt water cannot get to them by the deposit of the moisture that is in the atmosphere, and which deposits with changes of temperature. It was thought when the galvanized iron uninsulated outer was introduced that the galvanizing would protect the wires sufficiently, but as marine engineers know well, galvanizing after all is only a partial protection. The zinc coating protects when it is perfect, and as long as it lasts. It protects for a considerable time if the galvanizing has been very well done indeed, and the zinc has become practically alloyed with the iron. But it is not safe to rely upon that, and, in addition, both salt

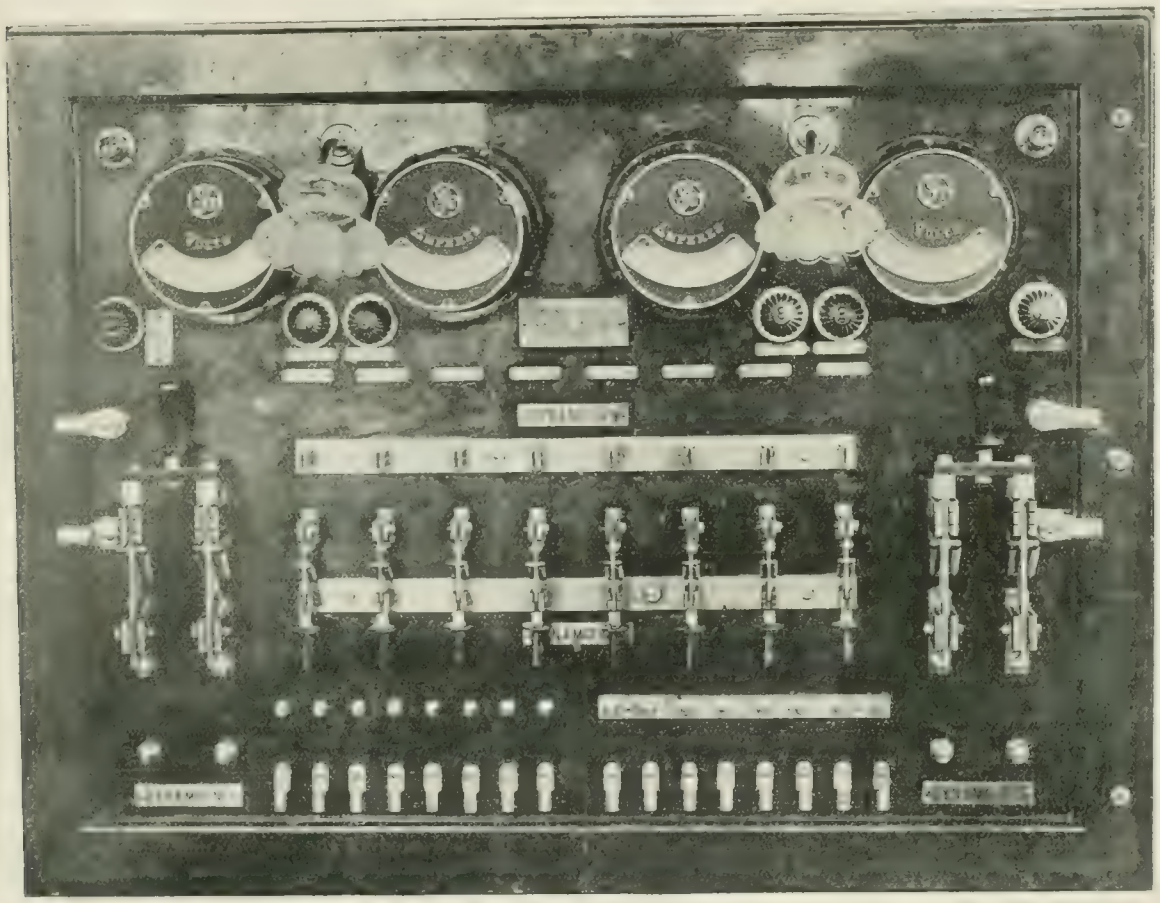
* For Articles I. to IX., see last nine issues.

water and the moisture deposited from the atmosphere, however it may be composed, eat it away, the outer conductor itself is reduced at that point, and sparking may follow if the whole of the outer conductors are parted. The lead tube provides a very much more satisfactory protection for the cable, since lead is very much less attacked than either zinc or iron, and, in addition, the lead tube, if properly worked when put on the cable, can be made very much more flexible than galvanized iron wires are, if the cable is of any size.

With the uninsulated outer, however arranged, the same central contact lamps are employed, and the same lamp fittings, brackets, etc., the outer conductor being connected to the lamp bracket, and the return connection to the lamp being also through the lamp bracket.

advantage which is practically part of that already named, is the great simplicity of the single-wire system, and this applies whether the ship is employed as a return or whether concentric cable is used. Using the ship as a return is the simplest, though there is not very much between them.

The concentric system also enables the conductor to be very much better protected than with two cables. The lead tube itself is perhaps the best protection that has yet been devised for board ship cables, and, bedding as it does in the concentric cable upon a mass of copper wires, instead of upon the insulating envelope, the possibility of damage of the insulating envelope, while the tube is being put on, or while the cable is being fixed, as when bending round corners, etc., is considerably reduced. Further, the chances of the eating away of either of the conductors by electro-chemical action,



Main Switchboard made by Messrs. Clarke, Chapman & Co., Limited, for two dynamos working on the Independent system, the wiring being on the double-wire system. Double pole switches are shown on the right and left, one for each dynamo, and eight single-pole double-throw switches in the middle of the board, for the distributing cables. Two sets of fuses are shown, for each distributing cable at the bottom of the board.

Advantages and Disadvantages of the Single-Wire System.

The great advantage of the single-wire system is the fact that only one cable has to be handled everywhere. Marine engineers will thoroughly appreciate the enormous advantage of this. In the case of men of war and of large ships of the mercantile navy, in which thick water-tight bulkheads have to be cut through for the passage of the cables, the advantage of only cutting a hole for one cable, and of it being of no consequence that the outer side of the cable makes contact with the edge of the hole, providing it is not a cutting edge, is of great value. As those who have had to fit up men of war know, the problem involved in carrying conductors through bulk heads and other obstructions is often a very serious one indeed, and therefore anything which can reduce the difficulties involved is a great gain. Another enormous

which is one of the most serious difficulties that are met with on board ship, is also very considerably reduced. Any moisture and any salt water that penetrates to the cable has first to eat away the lead tube, and then it has to find its way through the outer copper conductor to the insulating envelope, and thence to the inner conductor. There is, of course, the danger, when the lead tube is penetrated, of chemical action between the lead and the copper, leading to the eating away of the latter, but it is by no means so serious as the danger arising from the opening in an insulating envelope, allowing salt water to penetrate to the conductor of a single cable.

The great disadvantage, and that which has led to the abandonment of the single-wire system in a great many cases, is the fact that the currents, passing through the skin of the ship, affect the compasses. The return current, when it passes through the skin of the ship, will vary in strength

between any two parts of the skin, and will also vary in direction between two parts. Thus when lamps or motors in a particular part of the ship are in use, and when a large current has to find its way from them back to the generators, this current will divide between all the paths open to it, the ship's sides, bottom, stringers, etc., and there may be a comparatively large current passing sufficiently near one of the compasses to affect the needle. When the current taken by these lamps and motors is changed, say when the lights are nearly all turned out, the strength of the current passing in the neighbourhood of the compass will also be changed, and, as seamen know, the great difficulty in this matter is, not the fact that a physical force affects the compass, but that the strength of the force is changing. The concentric cable referred to overcomes the difficulty almost entirely, as nearly the whole of the return current will pass by way of the outer conductor, providing it is made sufficiently large to carry it. Stray currents may and will pass through different parts of the ship's mass, but again this trouble has been completely overcome, as the writer understands, by the introduction of Lord Kelvin's compass.

The illustration shows another main switch board made by Messrs. Clarke, Chapman & Co. It is for two dynamos, working together on the " Independent " system, the cables being on the double-wire system.

ELECTRICAL NOTES.

(From our Own Correspondent.)

CRANES worked by electricity received attention at the Institution of Naval Architects by a paper read relating to a system of shipbuilding berths adopted at Riva, near Genoa. In this case it was desired to take materials from any part of the yard near the berths and to carry them rapidly to any position on the vessels being built, and this economically ; to be able to carry on work in different parts of the vessel at the same time and independently, and to launch vessels with masts and funnels in place. To do this the plant consists of six electric tower cranes of 1·5 tons capacity each, placed in two rows, three on each side of the central berth. Each crane consists of a steel lattice tower of prismatic shape fixed on a concrete block. In the centre line of the tower is placed the turning mast supported by a bearing fixed on the concrete block and kept vertical by rollers fitted on the upper part of the tower. The horizontal jib on which the load truck travels consists of channel irons sustained by steel stay bars at the top of the twining mast. On each crane there are three 110 volt continuous current motors, one of 8·3 H.P. to actuate the lifting winch, one of 2·1 H.P. for moving the truck along the horizontal jib, and the third of 3·2 H.P. gives the turning movement, all the gear being in the operator's cabin fitted under the jib. A feature is that the three movements being independent can be made together, thus reducing waste of time. Energy is conveyed to the motors from the bases of the cranes by bronze rings and copper brushes. The principal points of these cranes are summarised as follows :—Safe load 1·5 tons, height of jib from 69 to 82 ft., lifting speed 50 ft. per minute, travelling speed of load truck 92 ft. per minute, and turning speed at extremity of the jib 400 ft. per minute. Three years' experience has proved the utility of this equipment, the upkeep being practically nil. The essence of such a system is that these cranes will cover side berths as well as a middle one, and are put forward as cheaper than any other plan, both in first cost and labour-saving, over the old mast and derrick type.

Turbines are likely to be more utilized for electric generation as time goes on, and some of the features that appeal to users are worth stating. Lubrication is necessarily an important matter, and it is usual for each turbine to have its own system, consisting of a small single-acting pump operated off the end of the main shaft, the oil being retained in a reservoir in the bed plate and deilvered to the bearings after passing through a coil of pipe surrounded by water, which circulates through a tank for cooling purposes. The oil is returned to the reservoir after leaving the bearings. A good quality of oil lasts for months, only a little addition being required as make up. Another necessity is good steam—that is, the supply should be about the same pressure and temperature, a variation of 5 lbs. being the maximum. With turbines water must be prevented passing over with the steam, or trouble will ensue from wear on the nozzles and impulse blades due to the great velocity of the steam, and if any sediment is present this will lodge in the spaces and close them up, affecting the output materially and necessitating the machine being taken apart for cleansing too frequently.

The Electrical Co., Ltd., of London, in their A.E.G. steam turbine have a machine of the two-stage action type with two-wheel chambers with sets of wheels, the vanes being of special bronze, dove-tailed into the turbine wheels. After passing through a steam separator the steam enters the nozzles of the first stage, where it is expanded very nearly to atmospheric pressure. With the high velocity attained the steam then strikes the first set of moving vanes after being reversed in a set of return guide vanes, strikes the second set of moving vanes of the first stage, giving off its energy to the first set of wheels. Thence it enters the intermediate receiver and afterwards goes to the second set of nozzles, where the remaining pressure is transformed into velocity by expansion down to condenser pressure. What energy there is is then taken up by the second set of wheels from which the steam enters direct into the condenser. It will be noticed there are no high steam pressures in this turbine and no fear of unequal expansion and deterioration of parts subject to great strains, such as the wheels and vanes. By adopting, too, a velocity instead of a pressure turbine the axial length can be kept small, which obviously is in favour of mechanical stability and saves space. The steam consumption is given at what is a moderate figure, while the governor is such that when full load is thrown off the variation of speed is not more than 5 per cent.

In the Italian Navy electricity plays a very important part. Signalling has always been a great feature, and with the powerful projectors employed signals have been transmitted a distance of 50 k.m. For submarines electric driving is used also for steering and raising the ammunition. In the same service the torpedoes are driven and steered by the same means, while for elevating and working big guns electricity is the motive power also.

A paper has been read before the Royal Institution on " Recent Contributions to Electric Wave Telegraphy " by Prof. Fleming, a well-known authority on the subject. It was mentioned that nearly all the vessels of our Navy are fitted with the apparatus, and the Marconi Co. has fitted nearly one hundred mercantile vessels. It was shown that electric waves differ from waves of light in their length, the former being long and the latter very short. There are two forms of electric waves, the broken and continuous, or to give another name to them, the spark and arc. The latter type is that of Mr. Poulsen, now before the public. The author said it has been found that the spark system may be converted to the arc. A new electrolytic detector has been invented by which audible signals can be transmitted, and electric wave telephony is therefore an accomplished fact. The question of direction in sending waves was also touched upon, and the present position of the matter noticed. The paper and the experiments given therewith were very well received.

The Central Marine Engine Works.—We have received the first section of a new catalogue being issued by the Central Marine Engine Works, of West Hartlepool. This section takes the form of a concise description of the Central Marine Engine Works and a general review of the specialities made there. We understand other sections are being prepared which will contain illustrations of marine engines, boilers, auxiliaries, forgings, castings and other things manufactured at the works.

Messrs. W. H. Bailey & Co., Ltd., Albion Works, Salford, Manchester, have lately received a repeat order from the Indian Government for one of their " Davidson " patent double-ram pumping engines, of large size, for railway water supply.

INSTITUTE OF MARINE ENGINEERS.

ON Saturday, June 1st, the Institute of Marine Engineers paid a visit to the Erith Works of Messrs. Vickers, Sons & Maxim. The ordnance works of this great undertaking have an area of nearly twenty acres, a main gun factory covering over fifteen acres devoted entirely to the manufacture of quick-firing and automatic guns for naval and land service, and extensive additions laid down of late years, the whole of the works, when full in swing, giving employment to about 5500 workpeople. The first building inspected was the main machine-room, an imposing workshop 440 feet long divided into twenty-nine bays, and walking down one bay after another portions of the guns were seen in the machines in various stages of preparation, the jobs gradually increasing in size from the delicate telescope sights of the three-pounder to the huge pedestals and shields for the 6-inch and 7.5-inch, the automatic lathes, drilling, milling and other machines being nearly all specially designed for the production of the quick-firing guns. In this and in the new shop, perhaps even more elaborately fitted, which was afterwards inspected, much time was spent in examining some of the machines, more especially the Bateman's high-speed planing machine, the vertical boring mills and the automatic high-speed turning machines. The rifling machines for the big guns also claimed special attention, as did the frame in which the jackets are shrunk on to the barrels, the process being the subject of an explanation. Passing the smiths' shop, with its rows of forges now black and cold, the inspection-room was next visited. In the manufacture of a gun with a range of 9500 yards the minutest error in workmanship would have, of course, disastrous results, and it may well be believed that no risks are taken of turning out work the least shade out of truth, but surely the highest point of the mechanic's skill is reached when the work is turned out true to $\frac{1}{10000}$th part of an inch, the test to which it is subjected in this room before being passed. Here, as indeed throughout the works, one is impressed with the order and extreme cleanliness prevailing. In the gallery around this room are stored piles of shell carriers, tampions and other accessories. The next room visited revealed to a large extent the scope of the firm's work containing as it did a specimen of each variety of gun manufactured by them, from the three-barrel and five-barrel Nordenfelts, deadly looking instruments, but now very little used, to the latest type made by the firm. The quick firing guns turned out by Messrs. Vickers, Sons & Maxim include naval, field and mountain guns, howitzers and Maxims, from the famous "Pom-pom," which did so much service in South Africa, firing 300 1-lb. shots per minute, to the 6-inch gun, which fires 100 lb. projectiles, penetrating 4¼ inch armour at 5000 yards range at the rate of ten rounds per minute, and the 7.5 inch, firing shots of 200 lbs. weight at the rate of eight rounds per minute, which penetrate at 5000 yards range modern armour 7 inches in thickness. Other guns are made to fire 3 lb., 6 lb., 12 lb., 14 lb., and 18 lb. projectiles at rates of twenty to thirty per minute with velocities up to 2500 and 2800 feet per second. The instruction room was then inspected and the party treated to a practical lesson in the art of firing a "Maxim," the various operations being demonstrated. Here officers and others are instructed in the use of the guns, models of the larger sizes being used for the purpose. The greatest interest was manifested in the mechanism of the breach lock, also in the rows of polished and burnished shells, shrapnel and case shot, samples of every grade and weight manufactured in the works, some complete, others cut in section showing the inside arrangement; particularly interesting was the section of shell fitted with a time fuse and also arranged to burst upon impact, a remarkablely ingenious contrivance.

Electrical power is used throughout for driving the machinery, the power house, with its four great British Thomson-Houston multipolar generators of 255 volts and 700 ampères each, supplying the main machine-room and the older portion of the works, while the new section is supplied from the power station of the Erith Council. A short stay was made in the room where the smaller portions of the guns are blackened by an oxidizing process, and afterwards the new extension was visited, beginning with the splendidly fitted machine-room already alluded to, where, for the most part, motor-car work is constructed. Not only the size of the shop and the large number of up-to-date machines, but the symmetrical arrangement of the machinery and the evident consideration for the employés in the matter of light and space and in the arrangements for heating and ventilation, elicited many expressions of admiration. The new joiners' shop, where the wheels and bodies of the carriages are made, was next visited, but it was then observed that it was nearly seven o'clock, and to save a long wait a hurried departure had to be taken to catch the next train, foregoing of necessity the inspection of other parts of the works.

In the course of the afternoon an adjournment was made to the board-room, where tea was very kindly provided by the company. After tea, Mr. Frank Cooper, in proposing a hearty vote of thanks, humorously referred to the only experience of guns which some of those present had previous to that visit, when the old 14-pounder used to be fired at Gibraltar or Malta to advise the inhabitants that the mail had arrived, and the old "bo'sun" loaded his gun and applied a red-hot poker to the fuse. The unpropitious state of the weather was amply compensated by their reception that afternoon. Mr. T. F. Aukland seconded, and appreciatively remarked upon the kindness of the members of the staff who had given up their Saturday afternoon to conduct and explain. Responding on behalf of Messrs. Vickers, Mr. Lowe expressed regret at the unavoidable absence of Mr. Conradi, superintendent of the works, and assured the visitors that it was a pleasure to see them there and that their appreciation was sufficient compensation for any trouble to which the staff had been put.

ELECTRICAL PLANTS ON ROYAL MAIL STEAM PACKET COMPANY'S FLEET.

MESSRS. W. H. Allen, Sons & Co., of Queen's Engineering Works, Bedford, have lately supplied several large electrical plants for the magnificent new vessels of the Royal Mail Steam Packet Co.'s fleet. The following description may be taken as typical of the installation.

The generating plant consists of four sets of Messrs. Allen's vertical compound inverted open-type engines, having cylinders 10 in. and 17 in. diameter, with a stroke of 10 in. The engines run at 300 revs. per minute with a steam pressure of 100 lbs. per square inch at the stop valve, and are direct coupled to four pole compound wound continuous current dynamos, each having an output of 436 ampères at 110 volts.

The arrangement on the s.s. *Araguaya*, which was built and engined by Messrs. Workman, Clark & Co., of Belfast, is as follows. Three of the four generating sets are on the engine-room bottom platform and the fourth is in a room at the forward end of the engine-room on the main deck level. All four sets are the same size and the idea of having one set on the main deck level is that should the engine-room be flooded the emergency machine could be used for lighting the vessel. This emergency machine has a separate switchboard with mains led down to the main board in the engine-room.

The main switchboard is of enamelled slate and is divided into three panels—one for lighting, one for power, and the centre panel for the main switches and fuses, the recording instruments and the earth connections. The recording instruments consist of three ammeters and three voltmeters. The ammeters are graduated from 0 to 500 ampères and the voltmeters from 80 to 140 volts. The main switches are at the bottom of the centre panel and are double pole carbon break and six in number, three of which are for power circuits and three for lighting circuits. All the switches for lighting and power are carbon break type. The dynamos are arranged to run in parallel.

The emergency board is also of enamelled slate and has an ammeter and voltmeter and the necessary switches for the day lighting circuits, etc. There is also a special double pole switch for making connection with the main board for parallel running.

The installation embraces the following items: About 1260 16 c.p. lamps; six 30 in. ventilating fans; six 20 in. fans; four 35 in. fans; and one 48 in. fan. These fans ventilate the saloons, lavatories, stokehold, engine-room, etc.;

also there are about two hundred 12 in. cabin fans, distributed throughout the accommodation. There are also cargo clusters consisting of eight lamps and reflector with the necessary cable for lighting the various holds and 'tween decks; also there is a projector circuit for use if the vessel required to navigate the Suez Canal. In connection with the lighting circuit there are a number of electric glow radiators in the suites of rooms in highly-polished ornamental brass stands. These suites are a special feature in the Royal Mail Co.'s vessels and are sumptuously decorated.

The ventilating fans are by Messrs. Davidson & Co. of Belfast and are of the Sirocco type arranged either as supply or exhaust fans.

There are three electric-light switches in each first-class room: one at the door so that the room can be illuminated immediately on entering, one at the head of the beds, so placed that it can be reached from either bed, and one near the head of the single bed where fitted. The first-class rooms are also provided with portable reading lights; also in each there is a plug connection for a ventilating fan. Each fan has a speed regulator giving three speeds. The fan circuit is entirely separate from the lighting circuits.

The wiring is on the single wire distribution box system, and is lead covered and armoured in way of the engine-room and stokehold and vulcanized and braided in the accommodation run in wooden casings. In way of the compasses and bridge double wiring is fitted. There is a daylight circuit for lighting the dark rooms and passages, etc., and the total number of circuits is 41.

There are motors for driving the above mentioned ventilating fans ranging from 2½ to 10 H.P., also for driving the laundry machinery and all the galley machinery, which consists of knife cleaners, roasters, dough mixer, dish-washing machinery, and an electric lift, which runs from the first-class galley to the pantry. The lift has two motors and a change over switch so that in case of accident to one of the motors, the other is available.

The saloon is ventilated by twenty-two large ceiling fans, with aluminium blades, about 4 ft. 6 in. over the tips, in addition to the large motor fans previously mentioned. The smoke-room is also similarly ventilated, having twelve such fans. All the ceiling and cabin fans are supplied by Messrs. Bergtheil & Young of 12 Cumomile Street, London, E.C.

The laundry is electrically driven and ventilated, and in connection with the laundry electric handirons are used. These are manufactured by the British Prometheus Co., of London Road, Kingston-on-Thames, who are also the makers of the hair-drying apparatus and curling tongs used in the barber's shop.

Electric bell installation.—There is a complete electric bell installation for the first and second-class accommodation. Two pushes are fitted in each first-class room, having two or more berths and one push in the second-class rooms. Electric bell communication is also provided from the first and second-class rooms on each deck to the captain's bridge for the use of the steward in case of emergency. The indicators are arranged in positions remote from the accommodation to avoid any annoyance to the passengers.

Telephone installation.—There is telephone communication between the captain's bridge and the engine-room starting platform and between the bridge and the after docking bridge. These telephones are of the "loud speaking" type by Messrs. Graham & Co., of Crofton Park, London, S.E.

LLOYDS' REGISTER SCHOLARSHIPS.

REFERRING to the notice in our November number of the report issued by Lloyds' Register of Shipping, we have received, by the courtesy of the Principal of the Glasgow University, a sample paper showing the questions set to candidates for the bursaries in connection with Lloyds. We have pleasure in stating some of the questions for the guidance of our young readers who may desire information on the subject with a view to entering the lists as candidates, or for others who may, for the sake of exercise and experience, wish to study the questions and work them out for themselves.

University of Glasgow. Dynamics. Special paper for bursary candidates, two hours allowed. 1. State exactly what is meant by velocity (1) when uniform, (2) when variable. Define acceleration. At a particular instant a ship is steaming due north at a speed of 15 knots. Five minutes later it is steaming north-east at a speed of 10 knots. Find in magnitude and direction the change of velocity that has taken place. Find the average acceleration of the ship during the interval. 2. Show that the period of a simple pendulum is $2\pi\sqrt{\frac{l}{g}}$, where l is the length of the cord and g is the acceleration of a body falling freely near the earth's surface. A clock controlled by a simple pendulum keeps correct time when the length of the cord is l. Find the number of seconds lost by the clock in 24 hours if the cord has its length changed to $l+.000325l$. 3. A simple pendulum, consisting of a bob weighing 10 grammes hung by a fine cord, is kept deflected 30° from the vertical by a horizontal force applied to the bob; find the magnitude of this force and the pull on the cord, naming the units in which the results are expressed. A plummet of mass m is suspended by two threads of equal length l from two points in the same horizontal plane at distance $2d$ apart. Suddenly one of the threads is cut. Find the instantaneous change which takes place in the stretching force in the remaining thread. 4. Criticise the statements in the following quotation from a London paper: "In order to enable a train to attain centrifugal force by mechanical means it is necessary for the outer rail on a curve to be raised above the inner." Find the elevation which must be given to the outer rail in a railway curve of radius 300 yards in order that the resultant force exerted by a train (travelling round the curve at a speed of 40 miles per hour) upon the rails may be normal to the track. 5. State Newton's third law of motion, and give illustrations of its meaning. A nail which weighs one quarter of an ounce is driven in 1 inch by a single blow from a hammer. The hammer weighs 6 ounces, and is moving just before impact with a velocity of 8 feet per second. Supposing the nail and hammer to be quite inelastic (so that they remain in contact after the impact), find the average resistance of the wood to penetration. 6. Define a horizontal surface, and show that horizontal surfaces in a heavy liquid at rest under gravity are surfaces of equal pressure. What is the nature of the free surface when the vessel containing the liquid slides down an inclined plane (1) when the plane is frictionless, and the acceleration of the vessel along it is that due to gravity, (2) when the velocity of the vessel is uniform? 7. State the principle of Archimedes, and deduce it from the elementary principles of hydrostatics. Show how the principle can be verified by experiment. An iron ball is floating in mercury contained in a vessel. If water is gently poured into the vessel so as to completely cover the ball, what will be the effect on the position of the ball relatively to the mercury? Give reasons for your answer.

The Lloyds' Register Scholarship, annual value £50, is tenable for three years and is open to candidates intending to become students of naval architecture whose age does not exceed 23 years.

The names of competitors for these bursaries require to be given to the Assistant Clerk (Matriculation Office), on the 19th September of the year it is proposed to enter upon study. The University Session extends from October to March.

The Engineering Standards Committee.—The secretary of the Engineering Standards Committee, which is supported by the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects, the Iron and Steel Institute and the Institution of Electrical Engineers, have sent us a copy of each of the following, issued by the committee. No. 29, British Standard specification for ingot steel forgings for marine purposes. No. 32, British Standard specification for steel bars for use in automatic machines. These specifications can be purchased from any bookseller or direct from the offices of the Committee, 28, Victoria Street, Westminster, S.W.

G. Braulik.—A catalogue of porcelain and iron watertight fittings, which have been specially designed to meet the requirements for fittings where security from dirt or damp is essential, for example, when for use in mines, mills, chemical works, railways and on board ships. Special mention may be made also of the particular forms of arc lamp varieties and couplings, which are fully illustrated and described.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondents.)

THE heavy tonnage, the large number of vessels and the wide variety of the work are all features of the output of new shipping from Clyde yards during the second quarter of the year. The aggregate tonnage for the period —which at the time of writing is not quite completed— will not fall short of 175,000 tons, this figure being about 54,000 tons greater than for the first quarter of the year. The output for May alone was easily the largest on record, amounting as it did to 52,250 tons, and including such vessels as the 12,000-ton turbine steamer *Heliopolis* from Fairfield, and over a dozen screw steamers of more than ordinary tonnage. Other turbine vessels launched besides the *Heliopolis* during the period were the King's yacht *Alexandra*, the *Maori* for the Union Steamship Company of New Zealand, and a further cross Channel steamer from the stocks of Wm. Denny & Bros.; accentuating the variety of the work were an unusual number of dredger craft of different types and an unusual number of steam trawlers and drifters. One of the larger vessels of the ordinary type was the twin screw steamer *Corsican* of 12,000 tons, having triple expansion engines of 8500 I.H.P., built for the Allan Line by Messrs. Barclay, Curle & Company, Whiteinch, and illustrated in last month's launches and trial trips sections. The Clyde total output for the six months will approximate closely to 295,000 tons, which is well on to 35,000 tons in excess of the output for the first six months of last year, which was the record output for the period in the history of the Clyde shipbuilding industry.

Messrs. Lobnitz & Company, Limited, Renfrew, have received from the Swiss Canal Company an order for a powerful dredger of the same type as the *Ptolemee*, constructed by the same builders in 1905. The new vessel, which is the third ordered from the Renfrew firm by the Canal Company, is intended to serve in maintaining and improving the roadstead and entrance to Port Said. The vessel will dredge to a depth of fourteen metres and will be one of the most powerful dredgers in the world. The same firm have received an order for a powerful gold dredger of the latest design from the Incahuara Dredging Company.

Messrs. Fleming & Ferguson, Limited, Paisley, have secured an order from the Melbourne Harbour Trust for the construction of a steam hopper barge, a tender for the building of which was also lodged by local builders at Melbourne. The Paisley firm's tender amounted to £13,400, which is a figure £7800 less than the local tender. In connection with this it is interesting to state that it was remarked at the board that the material for the barge, if British built, would cost about £4000, the cost of bringing the barge to Melbourne would be £3000, while the cost of labour was £4490. The material for an Australian-built barge would cost about £5000, and the cost of labour would be about £14,350. That showed that the local tender was favourable, and that it was the cost of labour in Australia which made the difference. One member said if the Victorian tender had been anything like that of the English firm the Trust might have stretched a point in its favour.

Messrs. Caird & Company, Greenock, have contracted to build a mail and passenger steamer for the Peninsular and Oriental Steam Navigation Company. The new vessel is intended for the branch service between Bombay and Aden, which is run in connection with the company's China and Australia line. The vessel, which is a purely mail and passenger boat, with a minimum of cargo space, will have accommodation for nearly 300 first and second-class passengers, whose cabins will be to a large extent on the upper deck, and will possess the most perfect ventilation. The tonnage of this vessel will be 6000 tons, and her engines of 10,000 horse power will enable a sea speed to be maintained of eighteen or nineteen konts. She will therefore be of the type of the *Isis* and *Osiris*, which have carried the mails so successfully between Brindisi and Port Said, but will be nearly thrice the size of those steamers.

Tenders have been invited by the Clyde Trustees from the builders of the existing vehicular ferry steamers which ply across the harbour of Glasgow—Messrs. Wm. Simons and Company, Renfrew, and Messrs. Ferguson Bros., Port Glasgow, the former firm being the original inventors and builders of such craft—for a new vessel to overtake the greatly increased cross river traffic due to the closing of the tunnel at Finnieston. The new vessel is to be 24 ft. longer than the existing one, and to have carrying accommodation on the elevating deck for sixteen vehicles as against nine carried by the present vessel. The experiment was tried of having two vessels plying at the Finnieston crossing, running alternately from each side, and although it was found practicable under favourable conditions it was decided that under possible weather conditions and states of traffic on the river the employment of two vessels might be inconvenient and dangerous. The intention is to utilize the new vessel at Finnieston, transferring the existing vessel to the less crowded crossing between Whiteinch and Linthouse, and reserving the original and smaller vessel which presently serves there as a reserve vessel which may be brought into service while the others from any reason may be inoperative.

Ship repair and overhaul work in the Clyde district has for a considerable time past been very brisk, but now shows signs of slackness, only the routine work usual at the beginning of the tourist season being now in hand. One very notable exception, however, is the repairs about to be undertaken to the large cable steamer *Anglia*, which has been for several weeks in one of the Clyde Trust graving docks at Govan. This vessel was owned by, and did good service for the Telegraph Construction and Maintenance Co., Ltd., but was sold sometime ago to the Hamburg-American Co., who, it is believed, intended refitting her as a passenger carrying steamer. While proceeding to Belfast for this purpose she grounded off the Irish coast, and after very arduous labours was salved by the East Coast Salvage Co., under the skilful superintendence of Mr. Tom Arnit. Since being docked at Glasgow the survey made has revealed very extensive damage, so much so that it is found that to make the vessel good will cost more than the sum of £45,000, for which the vessel was insured. The Underwriters under the circumstances decided to regard the vessel as a constructive total loss, and the vessel was put up for sale by auction in London on the 18th inst. Locally the sale of the vessel is regarded with considerable interest, as the contract for repairing the vessel will in all likelihood be given to a Clyde firm by the new owners. The *Anglia*, it may be stated, was built in 1898 by Messrs. Vickers, Sons & Maxim, Barrow in Furness, and is about 450 ft. in length and carries 9300 tons D.W. on about 26 ft. draught, and has a speed of about 12 knots. Built as a cable-laying steamer, she is a very strong and heavily constructed vessel of the spar-deck type. Her bottom, over a large area, was severely indented by being ashore, the engines, in fact, having been bodily raised by the grounding and pounding on the rocks, but over all there was a remarkable absence of puncture and fracture.

The deputation of the Thames Conservancy Board, who are at present visiting the principal shipping centres of the country, paid a visit of inspection to Glasgow and the Clyde on the 21st ult. After being formally received in the Clyde Trustees' Hall, the party accompanied by members of the Trust, embarked on the steamer *Marmion* at Broomielaw, and visited Prince's Dock, graving docks and pumping station, Queen's Dock, and the new Rothesay Dock at Clydebank. After this the company proceeded down the Clyde to view the dredging operations at present being carried out previous to the *Lusitania* leaving the Clyde. The visitors were also shown over the new Cunarder at Clydebank. A cruise on the Firth of Clyde took place in the evening.

THE TYNE.

(From our Own Correspondent.)

Shipbuilding.—At the time of writing a very serious crisis in the shipbuilding and engineering industries of the North-East Coast appears to be imminent. The engineers have intimated their intention to hand notices in to terminate engagements on July 1st. This course has been decided

on by a ballot taken in the lodges, in consequence of the employers' refusal to concede an advance of 2s. per week on time wages and a corresponding advance on piece prices. As an indication of the interest taken in this question by the rank and file of the members, it may be stated that only a little over one-third took the trouble to vote. From this it is certain that the great majority of the men are not desirous to press this matter to a strike, or at all events are not very keen upon it, and it would seem that only those without responsibilities, who would like a holiday, with pay attached, during the summer months, are really wishful to enter into a struggle with the masters on this question. The moral of this is that *all* should be required to vote, and that at least two-thirds of the *whole* number should declare themselves in favour of a strike before such a step should be decided on. In the meantime, the decision of the arbitrator on the moulders' application for an advance of wages is being anxiously awaited, as it is felt that should the award be against granting an advance, the position of the engineers will be so weakened that they will be compelled to withdraw from the dangerous position they have taken up. A decision in favour of the moulders' application would not necessarily affect the masters' position, for they understand the situation too clearly, and would know that such a decision could only be arrived at from an imperfect understanding of the facts. The shipbuilding operatives have also put in a claim for an advance, which, like that of the engineers, has been refused on the same grounds, namely, a manifest falling off in the volume of trade. The action of the Boilermakers' Society leaders in this matter can hardly be described as independent, it being evident that their intention is to stand firm just as long as the engineers do, but not a moment longer. It is possible that further complications may be avoided by a postponement of the consideration of the matter in dispute, and we trust it may turn out that a temporary settlement will be arrived at in that way.

We are pleased to note that the first shipbuilding yard below Newcastle Swing Bridge (Messrs. Wood, Skinner and Co.'s) has all its berths occupied, two of the vessels on the stocks being in very early stages. This firm has still a good foreign connection, which we doubt not they will long maintain, and they also get a good share of British orders for cargo boats, which accounts for their continued briskness. At Messrs. Armstrong, Whitworth & Co.'s Low Walker Yard there is a distinct improvement, all the berths being occupied with vessels in various stages of construction. At the adjoining yard of Messrs. Wm. Dobson & Co., however, there are only two vessels on the stocks, two berths being vacant.

Messrs. Swan, Hunter & Wigham Richardson, Ltd., have launched two important vessels this month; but have now some half-dozen berths vacant. Another pontoon dock has been laid down in one of the covered berths at the west side of the Wallsend Yard. The Trinidad floating dock is being rapidly completed in the water. At the company's Low Walker Yard two large passenger steamers are being repaired in the water. Both these vessels are, we understand, owned by foreign syndicates.

Messrs. Robt. Stephenson & Co. have three vessels on the stocks, but an equal number of berths are without occupants. Their large graving dock is occupied by a passenger steamer of large size, which is receiving an extensive overhaul.

Messrs. Hawthorn, Leslie & Co. have also three vessels building and three berths empty, and their graving dock is also occupied by a large vessel which is receiving a thorough repair.

The Palmers' Company have at present some three or four berths vacant, but it is understood that they have work to put down, and the yard will soon present a livelier appearance than it has at this moment. A large force of men is employed on the battleship in the water, which is now well advanced towards completion. The Tyne Iron Shipbuilding Company have one of their three building berths vacant, which for this firm is a very unusual circumstance. The Northumberland Shipbuilding Company have also two berths vacant, and Messrs. Readhead have one unoccupied. Some of the smaller yards near the entrance have also empty berths, and it is quite safe to say that in the aggregate there are not less than twenty berths now vacant on the river.

Engineering. In proof of the assertion that trade is declining, we need only point to the fact that some of the leading engineering establishments on the Tyne have discontinued night shift—this at a time, too, when night work is much less expensive than in the winter months. The Executive of the Engineers' Society say that they have only 2½ per cent of their members out of employment, but if this be correct, then there must be a very large number of engineering operatives outside the pale of their society; for it is well known that the proportion of men out of employment is much too large to be indicated by any mere fraction.

The Wallsend Shipbuilding Company are, we understand, well advanced with the machinery equipment of the *Mauretania*, and they are also fitting with engines, etc., a large passenger vessel recently launched at Wallsend. The North-Eastern Marine Engineering Company have two vessels being fitted with machinery at the wharf, and in the shops there is a good deal of work going on. The Turbine Works (Messrs. Parsons) at Wallsend are extremely busy.

The award of the arbitrators in reference to the iron-moulders' application for an advance of wages has been made known, and it is that no case for an advance has been established. Concurrently with this announcement comes the information that the engineers' application for an advance has been officially withdrawn. The other bodies that have applied for advances will doubtless also withdraw their claims, and a continuance of peaceable relations between employers and employed in the shipbuilding and engineering trades now seems assured.

THE WEAR.

(*From our Own Correspondent.*)

Shipbuilding.—Messrs. J. L. Thompson & Sons launched a week ago the fine steamer *Morawitz*, which is nearly 400 ft. long, and is equipped in the best possible manner for effectiveness and economy of working. Her owners are the Sea Navigation Co., Ltd., London and Budapest. The keel for another vessel has since been placed in the vacated berth. The Sunderland Shipbuilding Company have, we understand, obtained from a foreign firm an order for a fast steamer of superior equipment, the construction of which will be proceeded with immediately. Messrs. Austin have during the last fortnight been carrying out general repairs to the s.s. *Gladys Royle*, which has been placed on their pontoon dock for the purpose. The firm have had other vessels under repair in their graving dock and in the river, and have been kept well employed in this branch of their business. Messrs. Robt. Thompson & Sons are now repairing the locally owned steamer *Perseverance* in their Bridge Graving Dock, and it is understood that other vessels are expected at the dockyard shortly for reclassing. We hear that Messrs. Osborne, Graham & Co., of the North Highton Yard, are installing a complete system of electric power in their establishment, and are in other ways adding to the efficiency of their plant and works. Messrs. Doxford are said to have booked some additional orders, and it is understood that Messrs. Laing have added to their engagements some important repair contracts.

Engineering.—The North-Eastern Marine and the Scotia Engine Works are still very busy, and Messrs. Doxford's engineering department is also very full of work. The electrical department of the Sunderland Forge and Engineering Company's works is still kept fully going. In the forge department there does not appear to be any exceptional pressure, but the work in hand is sufficient to keep a large proportion of the machinery in operation.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

THE traffic returns of the Manchester Ship Canal for May show a total of £42,683. For the corresponding month last year the total was £40,123. For the first five months of the present year the receipts exceed the total of the first five months of 1906 by £12,349.

The House of Commons Committee have approved of the Manchester Ship Canal Company having power to pump water out of the Mersey for use in the locks. The traffic has increased so much that the ordinary sources of water supply fail to meet the requirements of shipping. Some of the vessels using the canal are 500 ft. long with 50 ft. beam, and 10,000 tons capacity.

The marine strike in France was regarded here with some alarm, owing to the direct trading of Manchester vessels with French ports, a trade which has shown a steady increase during the last few years.

The Lancashire timber trade shows no change of importance to record. Imports for the month of May to Manchester amounted to 175,000 cubic feet and 6000 standards. In May, 1906, the quantities were 42,000 cubic feet and 6890 standards. The stock at the Manchester docks on the last day of May was 1,043,000 cubic feet and 21,320 standards, as compared with 209,000 cubic feet and 16,180 standards a year ago, when the stock of sawn pitch pine, pitch pine planks and board pine was exceptionally light. There has also been a great increase in the stock of birch planks and spruce deals as compared with last year. During June the imports have been very considerable.

Not only in this country, but on the Continent generally, complaints are general of the shortage of railway trucks and delays in the transit of iron and coal. One company in Manchester secured delivery of laden coal waggons by informing a railway company that if certain trucks were not delivered within twenty four hours the contents of the waggons would be regarded as their property. The coal was delivered within the specified time.

There has latterly been a remarkable increase in the export of hematite iron from the North-West of England, chiefly to American and Continental ports. The total shipments up to date this year are about 500,000 tons, an increase of nearly 100,000 tons compared with last year at the corresponding date. Warrant stocks have seldom shown such a decrease as at the present time. Additional furnaces are being put in blast in order to cope with the demand, for makers still hold large orders for delivery to the United States and the Continent. Local steelmakers are also requiring larger deliveries.

The German Steel Syndicate has decided to maintain the present prices and selling conditions for all orders booked for delivery during the third quarter of the year. Trade is being pushed in this country, and the English demand for half-finished goods is stated to be very satisfactory. The German home trade is also in a good condition.

A few particulars from a correspondent with regard to the use of turbines for fishing boats may be useful to marine engineers. A turbine of the De Laval type, owing to the very high speed of rotation, requires gear wheels to be introduced between the turbine and propeller shafts. Even so, the propeller runs at a very high speed, and is said to be relatively uneconomical although the turbine itself should give a fair efficiency. The high speed of the propeller is, however, the cause of a serious falling off in its efficiency, when, for any reason, as, for instance, from head winds or the drag of the fishing nets, the resistance experienced by the boat is considerably increased. This loss of sea-speed, when exposed to head winds, is a serious drawback to the employment of turbines for ship propulsion, and the drawback is aggravated in fishing boats by the use of drift or trawl nets. It is generally conceded by engineers that turbines are not suitable for low-speed ships, although the De Laval type may be less unsuitable than the Parsons type. Then, further, a steam turbine does not reverse and a smaller reversing turbine has to be added.

For some time past a good deal of attention has been devoted to the search for new deposits of hematite iron ore in the North-West of England, and the Lindal Moor Co. have been successful in the Furness district in discovering ore in fifteen holes. Shafts are being sunk to get this metal, and it is believed that ere long the company will be able to raise 1000 tons per day compared with that quantity in a week, which has been the average output hitherto. Seeing that at present half the ore consumed in the blast furnaces of the district comes from Spain and Algiers, this discovery will have a very material effect on future production.

For the last two or three weeks there has been a dulness and lowering of prices in the Manchester iron market. So much pig iron and hematite has been exported to America and the Continent that stocks were practically exhausted. Smelters, nevertheless, are busy. New foreign orders are not yet all fulfilled, and so much iron has been sold for forward delivery at home that in this branch of the trade, at any rate, makers will be kept busy for some time to come.

There has also been a falling off in the price of tin and copper, but the ups and downs of these metals during the month have been so much of the "Jack-in-the-Box order" that it has been impossible to tell what a day might bring forth. Local buyers have not plunged far ahead in their metallic wants. Both in iron, lead, spelter, tin and copper it has been daily a "from-hand-to-mouth" business. Average quotations of pig iron, manufactured iron and hematites were about as follows:—Scotch metals, delivered Manchester docks, Eglinton and Dalmellington, 73s. 6d. per ton; Glengarnock, 76s.; Gartsherrie, 77s., with 2s. 3d. less if delivered at Heysham or Fleetwood, and 1s. per ton cheaper if landed at Preston. Middlesbrough iron, G.M.B., 65s. 6d.; Derbyshire, 66s.; Staffordshire, 66s. 6d.; Lincolnshire, 65s. 6d.; ditto, foundry, 64s.; ditto forge, 62s., delivered. Hematites, from the west coast, 78s.; ditto east coast, 80s. 6d. Seamless copper tubes, 13½d. per lb.; braized ditto, a farthing per lb. less, and seamless brass tubes 10⅞d. Local brass founders have had much to contend with in the high prices ruling for copper, but trade has been good; engineers had to be supplied with the requisite brass and copper fittings, and have had to pay for them pretty stiffly.

Manufactured iron has undergone few changes in price during the month, but the tendency, especially in bars, has been in favour of buyers. The latest quotations were on the following lines:—Iron bars (official), £8 per ton, though Staffordshire makers have been ready to accept as much as 10s. per ton below this figure; flats, £7 5s. to £7 6s.; angles, £7 5s.; tees, £7 10s. to £7 12s. 6d.; joists, £7 7s.; channels, £7 15s.; iron hoops, £8 7s. 6d.; steel boiler plates, £8 12s. 6d.; ditto ship's plates, £7 15s.

The Lancashire coal trade flourishes in every branch of fuel, save house coal, and that has only fallen in an infinitesimal degree compared with past years. Up to date we have had no summer weather; rain has fallen almost every day for the last five or six weeks. House fires have been a necessity. The pits are being worked full time, and so great has been the demand for engine and boiler fuel, gas coal and cannel and coal for shipping that prices continue to rule high, with no prospect of any diminution for the next twelve months. One Lancashire gas and water board has been compelled to pay something like a total increase of £4500 on last year's contract for coal and cannel for the twelve months next ensuing. The average prices quoted in our last issue for coal, coke, etc., still remain unchanged.

A party of the Conservators of the river Thames visited Manchester docks on the 19th June, having previously inspected works in the Mersey and at Liverpool. On the 20th they left for Glasgow.

On June 25th, 3000 workmen at the Manchester and Salford Docks came out on strike for an increase in wages.

THAMES.

(*From our own Correspondent.*)

WITH respect to the future action of the Government and their proposals for the regulation of the port, the President and other officials of the Board of Trade have now paid visits to the docks of the London and India Co., and made inspection of that company's dock estate. It was contended by those interested that such visits were necessary prior to any legislation which is likely to be of a far-reaching character and, of course, of vital interest to the company.

The Thames Conservancy have by their Act of 1905 made good progress with the works of dredging the Thames. To do this they let a contract, as their own vessels ordered were not ready by the end of 1906, and by these means they were enabled to remove 500,000 cubic yards from the Lower Hope. Above Gravesend 313,000 cubic yards have been removed to the end of the last year. In 1906 over 50,000 vessels entered and cleared the port, or an increase of 963 vessels over the previous highest year, 1903.

The Bridge House Committee of the Corporation report

progress with the widening of Blackfriars' Bridge, and there is a proposal before it to rebuild Southwark Bridge, which, if carried out, will be an important project and cost nearly three-quarters of a million of money.

As we foreshadowed recently, the P. & O. Co. have placed an order for a mail and passenger steamer with Messrs. Caird & Co., of Greenock, which firm, as is well known, have always been foremost in this connection. The P. & O. Co., as well as the Orient line, have vessels set aside for Norwegian cruises, and have arranged sailings practically every fortnight during the season.

The work at the Observatory at Greenwich, so important to the mercantile marine, is reviewed annually by a Board of Visitors, and recently this inspection took place with Lord Raleigh at the head. It is of interest to know that the chronometers and watches of the Navy are tested here. The Greenwich generating station chimneys, as affecting the work of the Observatory, were noticed again, and it seems by no means settled that the matter will rest where it is at present.

The engineering conference held at the Institution of Civil Engineers has had, in the marine department, Dr. Elgar delivering the James Forrest lecture on "Unsolved Problems in the Design and Propulsion of Ships," Lord Pirrie on Harbours and Docks as affected by Ships Developments, and another by the Hon. C. A. Parsons on Turbines for Marine Work. The papers generally were of a high and important character altogether, and the marine portion quite in the forefront.

This is the season for yacht racing, and the Thames has been busy recently with matches. The barge race has taken place from Gravesend under the auspices of the Thames Barge Racing Association, the winners receiving a cup presented by the Fishmongers' Company. In yachting the Royal London, the New Thames, the Royal Corinthian and the Royal Thames are the clubs that have raced over courses at the mouth of the river.

The engineering trades have been further dislocated by the strike at Erith, where about 2000 men are idle. The dispute appears to have arisen over the introduction of the bonus system. It is said that sights for naval guns are made here, and that accuracy is of the highest importance, and that therefore high speed is impossible. Hence the disagreement.

The *Empress* is the latest of the turbine steamers to be delivered at Dover from Messrs. Denny's yard, and she is stated to be the fastest boat yet built for Channel service. She travelled round from the Clyde in a little over 30 hours.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow.—The shipbuilding industry of this district has undergone no material change during the month. Builders are more fully employed on the contracts they have on hand, but they are not in a position to report the acceptance of any new orders. The demand for new shipbuilding tonnage is very quiet throughout the country, and there are but few enquiries for high-class vessels. The tramp class is of no value to builders in this district, as their plant and their appliances are all designed for the best type of work, and their workmen are also skilled for the class of ships on which careful construction and good, sound material are essentials. The draughtsmen's departments of local yards have, however, been very busy of late on prospective new work, some of which it is hoped to secure, but competition is now so keen that only a small percentage of the work it is hoped to get can be secured. Further, it is more than ever necessary to be thoroughly assured of the accuracy of estimates in order that builders may know of any chance there is of making a profit, as errors might sometimes lead to the placing of orders which might result in a loss. However, old-established firms have carefully prepared data as to the cost per ton of different classes of ships, and this acts as a good guidance in the putting out of new work.

There is no intimation from Prince Fushimi or from the Mikado's Government as to the firm which is likely to secure the order for the Japanese *Dreadnought* to be built in this country. It is understood there are only three firms in the running—Vickers, Sons & Maxim, Armstrong, Whitworth and Co., and Sir John Brown & Co. The chances are that the order will go to one of the two first-named firms. Barrow is not too well off for work, and could do very well with this order.

There is no further intimation about the placing of an order at Barrow for a Russian *Dreadnought*. Sometime ago it was intimated that the order had been placed with the representatives of Vickers, Sons & Maxim at St. Petersburg, and subsequently it was stated that it had been resolved by the Russian Admiralty to build all future warships in their own dockyards. Probably something definite would be known soon if Russian internal affairs were in a better state, but irrespective of this it is known that the Russian Admiralty are busy with plans for new ships of war of various sorts, and the hope is entertained that some of this work will come to builders in this country who have specially equipped themselves for this class of work.

It is understood that Chili and the Argentina are in the market for new warships, and that Peru is contemplating adding to its fleet which has just been strengthened by the new cruisers *Almirante Grau* and *Coronel Bolognesi*, now on their way to Callao, where it is expected they will arrive on Independence Day and be the subject of great rejoicing. It is being found necessary to strengthen the defences of Peru as much by reason of the immense wealth of this country and the disposition of other Powers to lay their hands on it, as from the fact that the opening of the Panama Canal will bring Peru into a position of greater importance to the commercial world. Chili and the Argentina are being forced to order ships in consequence of the action of Brazil in ordering a very big fleet. Not only is Brazil having three great *Dreadnoughts* built, but a large number of other classes of war and other ships which will make her a power only second to the United States on the American Continent, and Chili and the Argentina are on the watch as to the meaning of this very pronounced departure.

The work in hand at Vickers, Sons & Maxim's now embraces a Brazilian battleship of 19,000 tons, several British submarines, three steamers for the London and North-Western Railway Company, an Indian survey steamer, a Mexican transport ship, a powerful tug boat for the Furness Railway and a barge for the same company. What is wanted in the yard, however, is some Navy work such as big battleships or ocean liners, and the principal berths in the yard are being kept open for orders of this sort.

C9 submarine has been delivered during the month to Portsmouth. She is of the same class as that on which a fatal explosion recently took place. It is known in Barrow that this accident occurred in consequence of disregard to the very imperative printed regulations with which the submarines are all supplied; at the same time the question is receiving the consideration of all the expert engineers engaged in their construction as to whether some other agency might not be found for working the machinery of these vessels than gasoline. Electricity is looked upon with favour, but the means of storing it in sufficient and reliable quantities are not yet available. In the meantime the work of constructing an experimental submarine of the D type is proceeding, and considerable scientific attention is being devoted to this undertaking, as on her success will depend new orders. She will be larger and faster than any submarine yet launched, either when afloat or submerged, and she contains many improvements suggested by experience and approved by scientific research on the basis of that experience.

The Russian armoured and protected cruiser *Rurik* is now on the Clyde undergoing her machinery and speed trials. It is expected she will come out with a very good record. She has already had successful dock trials, and her heavy guns have been tested with gratifying results at Vickers' gun range at Eskmeals. When her trials are over she will return to Barrow to be completed for sea, and then she will sail for a Baltic port.

Marine engineers are much busier than they have been, and plenty of work is coming into the shops. Boilermakers have also more to do, and iron founders are very busy indeed. The brass and steel foundries are very well employed. The gun-mounting department is very busy, and orders are well held, but the demand for projectiles is quiet, and seems likely to remain so, as stocks are understood to be very large.

West Cumberland.—Steady activity is observable in the shipbuilding trade at Maryport and Workington, where there is always something going on no matter what the state of the shipbuilding trade may be. The two firms who have yards at these places are at present building a variety of small craft, and they have the assurance of further orders when those engaging their attention at present have been cleared away.

Shipbuilding Material.—The demand for shipbuilding material is well maintained, and orders have been given out more liberally of late. The mills are on full time on heavy plates and on half time on light plates. The local demand is fairly good and some big enquiries are coming from Belfast. Heavy ship plates approximate £8 per ton and light plates about £1 more.

Hematites.—The hematite iron trade is much quieter than it has been, as America, which was a good customer, is beginning to reduce the amount of her business with this district. Makers quote 82s. for their iron and warrant iron sellers are at 76s. net cash. Stocks have dwindled down to 27,315 tons.

Shipping.—Shipping is brisk at West Coast ports. The exports of iron and steel this year have reached 437,552 tons, being an increase of 84,651 tons on the corresponding period of last year. Freights are very steady.

SOUTHAMPTON.

(From our Own Correspondent.)

THE *Lusitania* arrived in the docks on the 30th May about 8 p.m. hundreds of people being on the docks to welcome her arrival. She sailed in the new mail service to the States on June 8th. During her stay in port she was thrown open for public inspection for one day, during which time about 20,000 people visited the vessel, and as the tickets of admission were sold at 1s. each for the benefit of local charities they have benefited to the extent of £500, which is very satisfactory. The owners of the White Star Line gave a luncheon on board on Saturday, June 1st, during which significant speeches were delivered by Mr. Sanderson as the representative of the White Star Line, Lord Pirrie, of Harland and Wolff's, and Sir Chas. Scotter, chairman of the London and South-Western Railway Company.

Mr. Sanderson said the exigences of the situation demanded that the White Star Line should seek a southern port, and they had come to Southampton determined, with the assistance of the South-Western Company and the port authorities, to do all in their power to develop the business which could be better worked through Southampton.

The London and South Western Railway Company have given the White Star Company most satisfactory assurances in regard to the provision of suitable docks and facilities, which, when completed, will be second to none in the kingdom.

The *Adriatic* took out 750 Italian emigrants who, owing to the French seamen's strike, were unable to sail in the French liner *La Provence*.

Messrs. Harland & Wolff. The contract for Messrs. Harland & Wolff's engineering works at Southampton Docks has been let, and we hear on good authority that the work will be carried out by the Waring White Building Company, of London, and that the contract price exceeds £30,000. The buildings will be commenced shortly, and will be erected as quickly as possible in order to enable Messrs. Harland & Wolff to undertake work as early as possible.

The Dredging Question at Southampton.—With reference to the above an understanding has been arrived at between the Harbour Board and the London and South-Western Railway Company, the agreement being that the London and South-Western Railway Company will lend the Harbour Board up to £50,000 at 3% and accept for it £37,500 of the board's 4% stock at par, which they can redeem at par when and how they like, and that when the stock is redeemed the loan will be fully paid.

The Royal Mail Steam Packet Company, whose head offices are at 18, Moorgate Street, London, E.C., have acquired a holding in a company recently registered to take over the business of the Shire Line (Jenkins and Co., Limited, 6, Lloyd's Avenue) who have a fleet of passenger and cargo steamers engaged in the Far Eastern trade. The vessels will load at Hamburg, Antwerp, Middlesbrough and London, and the usual itinerary of the Shire Line involves calls at the following ports—Penang, Singapore, Hong Kong, Shanghai, Nagasaki and Kobe, with Yokohama as the terminal Japanese port.

The Russian cargo steamer "Gerera," of Odessa, which was aground off Portland some time ago, came into the inner dock here to discharge her cargo into a sister vessel, after which she was placed in dry dock for survey. She was found to have sustained serious damage to the bottom, especially at the forward end. Temporary repairs were effected by Messrs. Thornycroft and extended over about a fortnight, after which the vessel proceeded to the Tyne, where, we understand, the repairs will be completed by Messrs. Smith's Dry Dock Company, of South Shields, who have secured the contract.

The Royal Mail Steam Packet Company have purchased the steam yacht *Mars* from Messrs. Marvin & Company, of Cowes. The vessel is 60 feet long by 11 feet beam and 32 tons T.M., and is at present lying in the inner dock here undergoing alterations before being steamed out to Vigo, where she will act as tender to the mail steamers of the Company's fleet. They have also placed an order with Messrs. Pickett of the West Quay, Southampton, for a steam launch for Rio de Janeiro, to act as tender there. The dimensions are as follows:—70 feet long, 13 ft. 6 in. beam and 8 ft. moulded. The engines and boiler are being supplied by Messrs. Plenty and Son, Limited, Newbury, and are compound surface condensing with cylinders 11 in. and 22 in. by 15 in. The boiler is 9 ft. 3 in. diameter, 9 ft. long, fitted with two Morison furnaces, and the steam pressure is 140 lbs. per sq. inch. It is anticipated that a speed of 12 knots will be obtained. The vessel is now nearing completion.

BELFAST.

(From our Own Correspondent.)

SOME sensation and a considerable amount of irresponsible writing in the press have been caused by the so-called Harland & Wolff-Brown "amalgamation." It has been stated that a serious reason for the "amalgamation" is the lack of graving dock accommodation in Belfast; but, seeing that Messrs. John Brown & Co. have no such accommodation, and that the Clyde Trustees refuse to allow their graving docks to be used for unusually long jobs, this reason can only be called absurd. Then it is said that Messrs. Harland & Wolff have entered into such extensive contracts for the building of "Combine" shipping that they can only carry out these by handing over some of the orders to Messrs. John Brown & Co.; but the facts that every steamer ordered by the White Star Company has been built by the Queen's Island firm, and that there is no hint that Messrs. Harland and Wolff are to have any interest in the Clyde firm, do not support this surmise. The only actual fact before the public is that the directors of Messrs. John Brown & Co. propose to ask their shareholders to authorize the raising of additional capital, part of which is to be used in acquiring an interest in the firm of Messrs. Harland & Wolff, and, as the former are large manufacturers of, and the latter large users of shipbuilding material, it is evident that the proposal is "good business," and requires no further explanation. Should the Belfast firm ever enter into a combination or amalgamation it may reasonably be expected to be of a different character from the affair which has caused such a stir at this time.

With regard to the Alexandra and new graving docks, it is interesting to note that Mr. Devlin, the present member of Parliament for West Belfast, recently asked Mr. Lloyd-George a long string of questions regarding these docks—questions which were intended to show that the Harbour Commissioners were injuring the shipbuilding trade of Belfast by not pushing forward the repairs to the former and the construction of the latter dock. Mr. Devlin also attempted to make out that the harbour franchise was

restricted. To the various questions the President of the Board of Trade gave a categorical reply in Parliament on the 14th curt. This reply, showing as it did that the Belfast Harbour Commissioners are elected on a much larger franchise than that of Liverpool, Glasgow or Dublin (as a matter of fact, it is greater than that of these ports combined), and that they, the Belfast Harbour Commissioners, were keenly alive to the great importance of their graving dock accommodation, cannot have been considered very satisfactory by Mr. Devlin and his advisers. Then, any small satisfaction which they may have felt must have been swept away by the detailed, explicit and interesting statement by the chairman of the Harbour Commissioners—Mr. Thompson—at the statutory meeting held on the 18th. Mr. Thompson stated that the Commissioners, their consulting engineers, engineer and the contractors were doing all in their power to expedite the work at both docks, and that the Alexandra Dock was expected to be ready for work this year, and the new dock in twenty-five months from now. He further stated that relations between Messrs. Harland & Wolff and the Commissioners were never more cordial than at present, and that a period of unparalleled prosperity for shipbuilders and for the port might be confidently expected.

Messrs. Harland & Wolff have completed and sent to sea two large steamers since last month's notes were published, namely, the Elder, Dempster liner *Fulani* and the *Avon*, which is the latest addition to the Royal Mail Steam Packet Company's fleet. The dimensions of the *Fulani* are—length 370 ft., beam 49 ft., depth 25 ft. 4 in., and gross tonnage 4000. The vessel is similar in every respect to the *Aburi* and *Sierra Leone*, finished earlier in the year. Another sister ship for the same company, the *Prahsu*, will shortly be completed and ready for her trial trip. The Royal Mail Steam Packet Company's *Avon* is a magnificent twin-screw mail steamer of about 11,000 gross tonnage. Her length is 534 ft. 9 in., and beam 62 ft. 4 in. The passenger accommodation may briefly be described as sumptuous. The machinery consists of two sets of quadruple expansion engines, which are balanced so as to reduce vibration to a minimum. Altogether, the *Avon* is a vessel which reflects the greatest credit on her builders and is also further evidence of the present go-ahead policy of the Royal Mail Steam Packet Company. Further particulars of the leviathan which is to be built for the International Mercantile Marine Company will be awaited with interest. This vessel, according to the company's annual report, will be "a fast steamer for the North Atlantic trade, which is to surpass anything hitherto attempted, both as regards size and luxury of appointment." Even at a time when some people talked about 600 or 700 ft. being the limit to the length of vessels, Lord Pirrie held that it would not be many years before a length of 1000 ft. was reached; and it is quite probable that he himself will live to see a steamer of this length. After all, as he said, the great difficulty is not in the building, nor the handling of such a vessel, it is really a question of depth of water in docks and other waterways. Of course, it may eventually be found that there is a limit to dimensions, beyond which the running of a vessel will prove unremunerative.

Messrs. Workman, Clark & Co. have also put in the water two new steamers since last month's issue. The first was the twin-screw vessel *Whakarua*, built and engined by them for the Tyser Line, of London. The second vessel was the *Sao Paulo*, which is the third vessel launched this year by them for the Lloyd Brazileiro, the other two being the *Ceara* and the *Para*. Messrs. Workman, Clark & Co. have an exceptionally large number of orders on hand at present, and they have recently constructed another building berth in their South Yard.

The strike of dockers referred to in last month's notes does not appear to be any nearer settlement. At that time it was confined to the men working on the Belfast Steamship Co.'s vessels, but since then several other firms have become affected. So far as the Belfast S.S. Co. at least are concerned, it appears that numbers of the men are willing and anxious to return to work, but the company declines, and rightly too, to enter into negotiations with the paid agitator who is engineering the strike. This man has been returned for trial on a charge of assaulting one of the imported labourers and causing him actual bodily harm, and the labourer has been similarly dealt with on a charge of cutting and wounding a local labourer. Bail was allowed in each instance. There is also a strike of iron moulders on in Belfast at present, the result of the refusal of the masters to grant an increase of wages.

JUNIOR ENGINEERS.

X.*

By W. W. A.

These columns are mainly intended for Apprentices, and we shall be glad to answer any queries or explain any points that are not perfectly clear, and to recommend books on the various subjects under discussion.

Moulding *(continued)*.

THE pulley wheel shown is such as may be used for lifting or turning gear, and provides a good illustration of a two-part mould with an extra parting, owing to the form of the rim.

The pattern is in halves, with a recessed joint, dowelled together, the parting being round the rim.

One half of the pattern is laid upon a wooden board, termed a turning-over board, and a moulding flask placed over this, Fig. 1; facing sand is sieved over the pattern and the box then filled up and rammed with ordinary sand and the wooden pin placed in at A to form the gate for the metal.

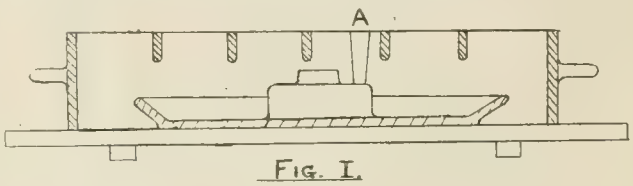


FIG. I.

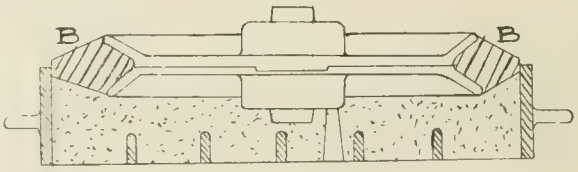


FIG. II.

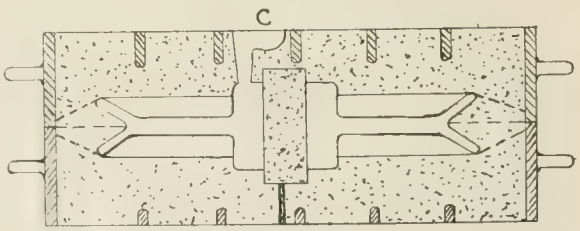


FIG. III.

The whole is inverted and the sand round the rim scooped out, the mould made firm and sprinkled with parting sand, the other half of the pattern is then placed in position and facing sand filled into the rim to form the shaded portion B and lightly rammed. The other flask, the drag, is now placed over the pattern and secured to the cope by means of pins passed through the lugs cast on the sides of the boxes. Parting sand is sprinkled over the mould at B, facing sand sieved over the pattern and the box filled and rammed up with ordinary sand.

The drag is now lifted off, taking with it one half of the pattern, and inverted, the sand round the edges of the pattern is made slightly damp to prevent it lifting, and this half of the pattern removed from the mould. The drag is replaced upon the cope, secured with pins, and the two boxes inverted, the pins removed and the cope lifted off and the other half of the pattern removed from the mould.

Charcoal powder is dusted over the mould, the core placed in position in the drag, the pouring basin C formed in the

* For Articles I. to IX., see last nine issues.

cope the boxes once more closed and secured with the pins, and a sufficient weight having been placed upon the cope to resist the upward fluid pressure, the mould is ready to receive the metal.

The pouring basin is formed as shown, so that the metal receives no momentum, but merely overflows from the deeper portion of the basin, further assisting the impurities to collect at the surface of the gate.

Venting may be provided for by piercing the sand, before the pattern is removed, with a thin wire and leaving a larger vent from the core down through the drag.

With small wheels of this type the sand round the rim obtains sufficient support from the sides of the flask; with large wheels, however, or deeper rims it may be necessary to strengthen the mould by means of iron wires or nails, and in the case of the largest sizes the moulding flasks are dispensed with, the mould being formed on the floor and the rim supported with a cast-iron ring.

REVIEWS.

The Naval Annual, 1907. Edited by T. A. Brassey. Portsmouth: J. Griffin & Co., 1907.

THE twentieth issue of the *Naval Annual* comes at a time when the minds of thoughtful people are disturbed by the many and great changes which are taking place in our Navy, and when some assurance from a competent and unbiassed authority would be welcomed by the man in the street. The *Naval Annual* should be able to afford that clear and statistical answer which men's minds seek. We cannot, however, take from it all the comfort we should desire. As the preface tells us, extravagant claims have been put forward on behalf of some of the reforms recently introduced —as, for example, the assertion that large economies would be effected by the wholesale scrapping of the more obsolete vessels of the fleet. It has been shown, conclusively enough, that the promised economies were not of a substantial kind, and the natural reaction followed. Public confidence in the present Board of Admiralty was to some extent shaken, because, the extravagance of the claims in this direction being realized, there was a kind of fear that all was not well throughout the whole department. That fear, it is pleasant to assert, has no real basis. Some of the changes may—as the *Annual* suggests—have been unwise, others may have been carried too far. But these matters will adjust themselves. We have the fact remaining that our new type of battleship and of armoured cruiser seems to be the most powerful the world has ever seen. We have a start over other powers in the output of big ships, and with the means at our command we should not find much difficulty in retaining it. Further, we have done very well with our *personnel*, and upon that far more than on *material*—as Sir Crypian Bridge wisely insists in his excellent new book on naval warfare—the ultimate success of a nation in war must ever rest. If our gunnery has been improved in the course of recent years to such an extent that our men can make two hits where formerly they could make but one, the efficiency of our Navy is doubled, quite apart from considerations of the moral effect upon an enemy of an encounter with a foe who places a large majority of his projectiles on the target, which shelters his opponent and his weapon. We have also improvements in another direction to chronicle. There have of late been some regrettable incidents in connection with strandings and collisions in respect of vessels of the fleet. But it now appears that the Admiralty is taking vigorous steps towards the improvement of the system of navigational instruction, and towards putting this most important art on a more scientific basis. The adequate training of officers and men may make less show in the newspapers than the launch of new ships. But it is a matter of supreme importance nevertheless.

On the other hand, the advisability of introducing the short service system into the Royal Navy is disapproved by the editor.

On the question of the desirability of the abandonment of the secondary armament of battleships as followed in the *Dreadnought*, the editor makes one pertinent suggestion when he asks how far was the fact that the Japanese conducted their naval engagements, in which they proved so victorious, at long range, due to special circumstances, which need not necessarily occur again? The *Invincible* class of heavily armoured cruiser in its turn is criticised, on the ground that an admiral would be certain to put them in his line of battle, where their inferior protection would be a disadvantage and where their high speed could be of no value.

As regards the shipbuilding programme the case may be summed up as follows. Though there was no ground, under the special circumstances of the case, for the outcry against the Admiralty for dropping one of the battleships from this year's programme, our present predominant position in this arm will soon be lost and at the end of next year we shall barely be up to the two-power standard. Accordingly the editor insists that next year the vote for new construction must be increased. Further, in regard to cruisers, he points out that there is urgent need for the building of medium-sized cruisers for the protection of our commerce.

Our readers are necessarily much interested in the question of commerce protection in war time, and for that reason the chapter on the Manœuvres of 1906 will especially appeal to them. The lesson seems to be summed up in the remarks that in real warfare the capture or destruction of merchant ships by destroyers is likely to be less feasible than it appeared on this occasion, whilst it is certain that when the main fleet of the enemy is met and dealt with, the attacks of these marauding vessels will very soon come to an end.

Another chapter of great interest to the student is that which seeks to apply the teachings of history as derived from the study of the chronicle of the great Dutch wars to the present position in regard to the North Sea. One conclusion may be quoted. "It is doubtful whether Germany could long hold out in face of the suspension of this vast volume of trade (her sea-borne trade is valued at over 435 millions sterling, and is 69·8 per cent. of her total commerce), and it is in the hands of Great Britain to force that suspension as soon as events warrant." This may be true enough, but it is pertinent to ask how large a portion of that sea-borne trade could still be continued by the use of neutral ports more or less accessible by a short transit beyond her land frontiers.

The chapter on Naval Reorganization shows how difficult is the position of those who criticize the Admiralty upon its policy in regard to the repairs of the fleet. Expenditure upon ships which are likely to be soon obsolete is obviously sheer waste. A notable, if not very recent, instance was the case of the *Sultan*, which, as may be remembered, was repaired at huge cost after her accident in the Comino Channel and which, nevertheless, was never after that time of the least value as a fighting unit. Yet, on the other hand, there are many vessels, no longer fit for the first line, which, after a general action, might prove of immense value to the country. As has been said on more than one occasion, there are many ships, recently discarded by our fleet, for which the Japanese would have been profoundly grateful, had it been possible for them to have had possession of them during their life and death struggle with Russia. Policy here, as elsewhere, must be defined by the general war plan of the Admiralty—a plan which necessarily cannot be known to its critics. We must trust our Naval Lords in these matters or the position becomes intolerable. At all events it seems certain that much reform has taken place in our dockyards, obsolete machinery having been cleared out and replaced by that of the latest type, whilst patterns have been standardized and work simplified.

We must not deal with any other of the important points raised in the book. Suffice it to say that the usual tables of ships, ordnance and armour, as well as the appendices relating to naval estimates, are afforded. "Brassey" keeps up its reputation, and those who read this issue will be inclined to use their brains before they rush into print or on to the platform to discuss the alleged shortcomings of the British Admiralty.

Album Illustre du Flottes de Combat. By Commandant Balincourt. Paris: Berger Levrault, 1907.

THIS is a work designed to show the fleets of the world in a rapid way without going into too much detail. Each country is treated alphabetically, first a table of the vessels and then photos of the various types. With England we have the distribution in squadrons first, also for France; with the latter we notice views of submarines. These pictures of the ships are perhaps the most complete to be found in any

publication. They are not drawings, but actual prints, collected by the author from all sources, and which would appeal to the average reader. In addition there is a table showing the value to be appraised to the armament, and from this it is seen that the United States has the most heavily armed Navy for its weight in tons. Tables of distances from various points finish the book, which for general use, as also for officers, should prove most valuable.

South American Mail Service.—The Royal Mail Steam Packet Company's magnificent new steamer *Avon*, which we fully described in our April issue at the time of her launch, arrived in Southampton Docks on the 17th June from Belfast, where she has been built and engined by Messrs. Harland & Wolff. A press luncheon was given aboard by the Royal Mail Company on Saturday, the 22nd June, at which the following notes were taken of the main and auxiliary machinery, and which may be taken as typical of the A class of steamers, of which the *Avon* is the fourth. A further vessel is nearing completion at Messrs. Harland & Wolff's. The main engines consist of two sets of balanced quadruple expansion engines having cylinders 27 in., 38½ in., 55 in., 79½ in. and 54 in. stroke, and working at a pressure of 215 lbs. per square inch. Aspinall's patent governor is fitted to each engine. Steam is generated in four single-ended and three double-ended boilers. The single-ended boilers are 15 ft. 6 in. dia. by 10 ft. 9 in. long, and the double-ended boilers are 15 ft. 6 in. dia. by 19 ft. long. There are three furnaces in each single-ended boiler and six in each double-ended boiler, making a total of thirty furnaces. The furnaces are 3 ft. 9 in. internal diameter and are fitted with Messrs. Railton, Campbell & Crawford's patent firebars. The arrangement is as follows :—A weigh-bar runs along the front of each furnace, on which slides a lifting pawl actuated by a portable hand lever, so that by moving the pawl along the weigh-bar any firebar can be shaken as required. The bars are double and 5 ft. 6 in. long. The furnace doors open inwardly, the object being to prolong the life of the cheek plates, as the door cannot be opened unless the coal is well away from the cheek plates. Silley's patent smokebox doors are fitted throughout. The advantages of this type of door are as follows :—It keeps the smokebox perfectly tight, prevents buckling, is easily opened and closed, increases the efficiency, and effects considerable saving in the repair bills. The ashes are discharged overboard by means of two Sees ash ejectors, one in each stokehold (the water being supplied by a large pump in the engine-room). There is also a coal hoist by Messrs. Railton & Campbell for raising coal for the galleys, etc. Passing into the engine-room, we notice the electrical installation, which is on the middle platform level in a recess at the after-end, and consists of four sets of compound engines and four pole dynamos by Messrs. W. H. Allen, Son & Co., of Bedford. This installation will be found fully described on page 447. On the bottom platform between the thrust blocks is placed the hydraulic and refrigerating machinery. The hydraulic machinery is by Messrs. Brown Bros., of Rosebank Works, Edinburgh, and consists of a compound condensing steam engine, having cylinders 14¼ in. by 20 in. and 18 in. stroke, and a steam loaded accumulator 27 in. dia. by 61 in. stroke, which gives a water pressure of 1000 lbs. per square inch for working the ten hydraulic cranes with which the vessel is fitted. Eight of the cranes are 30-cwt. cranes and two are 2-ton cranes. These cranes are noiseless in action, thus adding considerably to the comfort of passengers. Messrs. Brown Bros. have supplied the whole of the hydraulic gear used in the Company's fleet. Aft of the hydraulic machinery is the refrigerating machinery by Messrs. J. & E. Hall, of Dartford, Kent. The plant is Messrs. Hall's No. 16 Duplex marine type on the carbonic anhydride (Co_2) system, which is too well known to need a detailed description. There are four brine pumps by Messrs. Mumford & Co. for brine circulation. The plant is dealing with about 128,00 cubic feet, besides the provision chambers. Coming into the engine-room, Messrs. Weir's feed pumps are seen at the fore end on the centre line of the ship. There are two sets with 15½ in. cylinders, 11½ pumps and 26 in. stroke, and an automatic control tank. The pumps have large air vessels on the discharge. Next the Weir's pumps is the Edmiston feed-water filter, and near it is the Quiggin's feed-water heater. From the above it will be seen what a large amount of auxiliary machinery these vessels have, and we purpose at some future date dealing with either the refrigerating or hydraulic installations in detail.

Lloyd's Register of British and Foreign Shipping.—Sir John Glover has resigned the position of chairman of Lloyd's Register of British and Foreign Shipping on account of advancing years, and his retirement took effect at the end of June. The committee received Sir John's resignation with much regret. He has been a member of the Committee of the Register since 1872, and was elected the chairman of the Society in May, 1899, on the death of the late Mr. W. H. Tindall. During his years of office the work of Lloyd's Register has increased enormously, both in quantity and in importance, and the distinguished success of his administration of the world-wide affairs of the Register is seen in the universal estimation in which it is held by the shipping community as the premier classification society of the world. Indeed, his chairmanship has not only secured for him the highest appreciation of his colleagues on the committee, but may not unfairly be said to have added fresh strength to the Society. It is a matter for satisfaction that Sir John Glover, while retiring from the office of chairman, does not intend to sever his connection with the Register, but will remain a member of the committee. At a special meeting held on May 30th, the committee unanimously elected Mr. James Dixon to succeed Sir John Glover as chairman. Mr. Dixon has been a member of the committee for the past thirty years, and has long been one of the best-known business men in the city, where his interests both in shipping and marine insurance have been extensive and varied. Until within the last five years Mr. Dixon was a partner in the firm of Harris and Dixon, of 81, Gracechurch Street, E.C., which was established over 100 years ago. He is a member of Lloyd's and is associated with some important undertakings. Mr. Dixon has for many years been a member of the committee of the General Shipowners' Society and has occupied the post of President of the Chamber of Shipping of the United Kingdom.

The case of Mr. William Smith Gill against Messrs. Dixon and Heydorn, of London, for infringement of patent for a paint remover, was put down for hearing on the 8th June before Mr. Justice Neville. We understand Mr. Gill's patent is the joint property of his firm, Messrs. Farquhar & Gill, and of Holzapfel's Compositions Co., Ltd., of Newcastle-on-Tyne, and according to it two well-known paint removers are manufactured, the one under the name of "Pyrol" by the former firm, the other under the name of "Pintoff" by Messrs. Holzapfel. The plaintiffs sought to restrain the defendants from infringing their patent. They were represented by Mr. Sebastian. When the case was called there was no defence and judgment for a perpetual injunction with costs was entered for plaintiffs.

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions of our correspondents.

Success in Advertising.

To the Editor of the MARINE ENGINEER AND NAVAL ARCHITECT.

Dear Sirs,—We have pleasure in advising you of the fact of our having received enquiries for our Sea Rings Patented from Amsterdam, Genoa and Cologne, and this during the period of the last three months.

We have spent heavy sums in advertising in many journals during the last five years in Great Britain, and, so far as we can trace, we do not think any of them have been productive of anything like the same number of enquiries in a similarly short period.

Since we were in doubt of the real advertising power your pages possessed when we first inserted our advertisement, we feel it only fair and due to you to give you the above plain statement of facts for what they may be worth.

With kind regards, and wishing you continued success, we are, yours faithfully,

RONALD TRIST & Co.

London, June 23rd, 1907.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Fitzpatrick.—On May 25th Messrs. R. Craggs & Sons, Ltd., launched from their Tees Dockyard, Middlesbrough, a fine steel cargo steamer 390 ft. long, 52 ft. 3 in. breadth, 28 ft. depth moulded. This vessel is being built to take the highest class under Lloyd's strengthened spar-deck rule, with two decks laid, having poop, bridge and forecastle. Very spacious and handsomely fitted accommodation is provided for the ship's company amidships under bridge deck, the crew being in the forecastle. Cellular double bottom is fitted throughout for water ballast which is also carried in after peak, and to insure the ease of making good passages in unloaded condition a large deep tank, available also for cargo, is fitted amidships, the total ballast capacity being about 1900 tons. Nine powerful steam winches are provided of the most approved type. Steam steering gear is supplied and improved quick-warping steam windlass is fitted forward. The arrangements for handling ship and cargo are most complete in every respect, and the design contemplates the carrying of about 7250 tons on a very light draught with a speed of 10 knots. The machinery is to special specifications and will be fitted by the North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne, and will have cylinders 25 in., 41 in., 68 in. by 48 in. stroke, steam being supplied by three large single-ended boilers working at 180 lbs. to the square inch. The vessel has been built to the order of Messrs. Burrell & Son, of Glasgow, and on leaving the ways was named *Fitpatrick* by Miss Dorothy Stephenson, of Middlesbrough. The specifications have been supervised and the construction of the hull and machinery has been carried out under the superintendence of Mr. J. C. Stewart, assisted by Mr. D. Millar as resident surveyor.

Abonema.—On May 27th Messrs. Irvines' Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, launched the handsome steel screw steamer *Abonema*, built to the order of Messrs. Elder, Dempster & Co., Liverpool. The *Abonema* is a beautifully modelled shelter-deck vessel, and is the first of two which Messrs. Irvines' Shipbuilding Company have in hand for the above owners. The vessel is intended for service on the West Coast of Africa, and is of the following dimensions, *viz.*:—Length, 336 ft.; breadth, 46 ft., and depth 25 ft. 3 in. moulded. Classed 100 A1 Lloyd's, having cellular double bottom all fore and aft, with large after peak tank. The vessel is divided by six transverse bulkheads into seven compartments and with three complete decks, all fore and aft. Every attention has been paid to appliances for rapid loading and discharging of cargo, the vessel having nine steam winches of the firm's own make and eleven derricks, one derrick of steel with fittings capable of lifting fifteen tons. Accommodation is provided for the captain and chief officers, state rooms, etc., with dining saloon in house amidships, captain's day room, chart and wheel-house above. Under the upper flying bridge the engineers and remaining officers, with baths, and w.c.'s, are placed in steel houses abreast of engine and boiler casing on the shelter deck, with promenade and boat deck overhead. The firemen, seamen and petty officers, with their w.c.'s and wash-places, mess-rooms, etc., etc., are all placed aft under the shelter deck. A complete installation of electric light by Messrs. Campbell & Isherwood is fitted throughout the vessel, including signal lamps, binnacles and cargo clusters at each cargo hatch, as well as oil lamps for emergency purposes. Steam steering gear is placed amidships with leads aft to quadrant let alongside of hatches, quick warping windlass forward and large multitubular donkey boiler of ample capacity for the supply of steam to the deck machinery. Engines of the triple expansion type are being supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, having cylinders 24 in., 40 in., 66 in. dia. by 45 in. stroke, steam being supplied by two extra large main boilers working at a pressure of 180 lbs. per square inch. The christening ceremony was gracefully performed by Miss Margaret Boyd Carpenter, daughter of the Bishop of Ripon, and there were also present Misses Holton, Miss Baxter, Mr. and Mrs. H. Withy, Mr. and Mrs. A. S. Purdon, Mrs. Ross, Mr. Roxburgh (representing the owners) and Mr. J. T. Harris.

Fram.—On May 28th there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, a steel screw steamer built to the order of Herr H. M. Wrangell, of Haugesund, Norway, and of the following dimensions, *viz.*:—Length, 325 ft.; breadth, 47 ft.; depth moulded, 23 ft., and built to Norwegian Veritas highest class on single-decked rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including six double-cylindered steam winches, direct-acting steam windlass, large donkey boiler, steam steering gear by Messrs. Donkin & Co., and Hastie's screw gear aft. The engines, which are to be supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend, are of the triple-expansion type, having cylinders 23 in., 38 in. and 62 in. by 42 in. stroke, and working at a pressure of 160 lbs. On leaving the ways the vessel was named the *Fram* by Miss Karoline Wrangell, of Haugesund, daughter of the owner.

Ivar.—On May 28th Messrs. William Gray & Co., Ltd., launched at West Hartlepool the handsome steel screw steamer *Ivar*, which they have built to the order of Mr. L. H. Carl, Copenhagen. She will take the highest class in Lloyd's and is of the following dimensions, *viz.*:—Length overall, 295 ft.; breadth, 43 ft., and depth, 21 ft. 3 in. with long bridge, poop and topgallant forecastle. The saloon, state rooms, captain's, officers' and engineers' rooms, etc., will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep frames, cellular double bottom and large aft and fore peak ballast tanks for water ballast, six steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass and Cochran (Annan) donkey boiler with patent seamless furnace, shifting boards, stockless anchors, telescopic masts with fore and aft rig and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 22 in., 36 in. and 60 in. dia. with a piston stroke of 39 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. The ceremony of naming the steamer *Ivar* was gracefully performed by Miss Isabel Hay, Garsdon Rectory, Malmesbury.

Southward.—On May 28th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 120 ft. by 22 ft. by 11 ft. 6 in. depth of hold. The vessel has been built to the order of Messrs. The Forward Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes and Co., of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Southward* by Miss Ruby Bannister, of Grimsby, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Cardigan.—On May 29th Messrs. Ropner & Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.*:—Length, 370 ft., breadth, 51 ft., depth, 26 ft. The vessel is built to the highest class in the British Corporation Registry, and has been built to the order of Messrs. Jenkins Brothers, Cardiff, and is fitted with the builders' patent improved trunk deck. The saloon house, with accommodation for captain and officers, and a house for engineers will be fitted up on trunk deck, with the crew in the topgallant forecastle. The vessel has double bottom for water ballast on the cellular principle, also in the after peak tank. The deadweight carrying capacity will be about 7100 tons. The vessel will be fully equipped with an up-to-date outfit, having a quick warping windlass, stockless anchors, steam steering gear amidships, with powerful screw gear aft. The appliances for loading and discharging expeditiously are very complete, and include extra derrick posts and double derricks, six steam winches, steam being supplied by a large horizontal donkey boiler. The engines will be of the triple-expansion type supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, of about 2000 I.H.P., steam being supplied by two extra large main boilers at a working pressure of 180 lbs. per square inch. The christening ceremony was gracefully performed by Mrs. Jenkins, of Cardiff, who gave the vessel the name of *Cardigan*.

Celebes.—On May 29th Messrs. Furness, Withy & Co., Ltd. Hartlepool launched the large steamer *Celebes* which they have built to the order of Messrs. The Stoomvaart Maatschappij, "Nederland," Amsterdam. The vessel exceeds 407 feet in length and has a measurement capacity of 11,725 tons, built to highest class at Bureau Veritas. She is of the three-deck type with two steel decks laid, shelter deck erections sheathed with teak all fore and aft, and a long boat deck above also built of teak. A cellular double bottom is fitted throughout for water ballast, the fore and after peaks being also available as tanks. Six water-tight bulkheads divide the vessel into seven water-tight compartments. Special attention has been given to all discharging gear, the ship being equipped with twin masts, four derrick posts (the latter arranged as ventilators), twelve derricks and twelve powerful steam winches, these together with six large hatchways, greatly facilitate the quick discharging of cargo. One twenty tons derrick will also be fitted to deal with heavy weights. The equipment also includes large multitubular donkey boiler, direct steam windlass, patent telemotor gear, electric light installation by Furness, Withy & Co., Ltd., patent fire-extinguishing apparatus, awnings all fore and aft, etc. Accommodation is provided for captain and officers in large steel deck-houses amidships, and the crew are berthed in the forecastle. Hospitals and galleys, etc., for natives are arranged on shelter deck aft. Triple-expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, the sizes of cylinders being 26½ in., 43 in., 72 in. by 48 in. stroke, steam being supplied by three single-ended boilers 11 ft. 3 in. by 14 ft., having a working pressure of 180 lbs. Mrs. C. J. Van Hulzen gracefully performed the christening ceremony.

Fraserburgh.—On May 29th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw drifter, the principal dimensions being 82 ft. by 18 ft. 3 in. by 9 ft. moulded. The vessel has been built to the order of Messrs. The British Coast Steam Fishing Co., Ltd., of Hull, and will be fitted with powerful compound engines by Messrs. Amos and Smith, of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Fraserburgh* by Miss Margery Spring, of Hull, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Frixos.—On May 29th Messrs. William Gray & Company, Ltd., launched at West Hartlepool the handsome steel screw steamer *Frixos*, which they have built for Mr. A. A. Embiricos, London. She will take the highest class in Lloyd's and is of the following dimensions, *viz.*:—Length overall, 367 ft.; breadth, 50 ft. 8 in., and depth 24 ft. 3 in., with extra long bridge, poop and topgallant forecastle. The saloon, state rooms, captain's, officers' and engineers' rooms, etc., will be fitted up in houses on the bridge deck and the crew's berths in the forecastle. The hull is built with deep frame, cellular double bottom and large aft and fore peak ballast tanks, six steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on beams overhead and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 40½ in. and 67 in. dia. with a piston stroke of 45 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. The ship and machinery have been constructed under the superintendence of Mr. A. Z. Kairis on behalf of the owners, and the ceremony of naming the steamer *Frixos* was gracefully performed by Mrs. Embiricos, London.

Malte.—On May 30th there was launched from the shipbuilding yard of Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, a steel twin screw passenger steamer which has been built to the order of the Compagnie des Chargeurs Réunis of Paris and Havre. The vessel is of the following leading particulars:—Length overall, 500 ft., 55 ft. 8 in. beam extreme, by 36 ft. 11 in. depth moulded. The vessel has been designed for the company's special service to the East, and will carry a total deadweight of about 9000 tons on a moderate draught of water. Accommodation will be provided for fifty-seven first-class passengers in very roomy cabins, the state-rooms being situated in the bridge, on the bridge in deck houses and also in deck houses above that again. The dining saloon will be at the front end of the bridge, and a drawing-room and smoking-room will also be provided, together with several suite-rooms. The furnishings and outfit will be of a very complete description and specially suited for a hot climate. Accommodation has also been provided for a certain number of steerage passengers, with lavatory accommodation of an ample description, so that the number can be extended at some future time. The machinery has been constructed by the Wallsend Slipway and Engineering Co., Ltd., Wallsend, and consists of two sets of triple-expansion engines driving twin screws, steam being supplied by six large single-ended boilers working at 180 lbs. pressure. This machinery is expected to drive the vessel at a speed of 14 knots loaded. On leaving the ways the vessel was gracefully named the *Malte* by Madame de Sayve, the wife of one of the directors of the owning company. The vessel and her machinery have been built under the supervision of Mons. Pinczon, the company's superintendent engineer, and Mons. Lorois, who has been the resident surveyor.

Tokio.—On May 30th there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 136 ft. 8 in. by 23 ft. by 12 ft. 3 in. depth of hold. The vessel has been built to the order of Messrs. Pickering and Haldane's Steam Trawling Co., Ltd., of Hull, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, of Hull, and is replete with all the latest improvements for fishing purposes. As the vessel left the ways she was gracefully christened the *Tokio* by Miss Christensen, of Hull, after which the company adjourned to the builders' offices, where breakfast was served and the customary toasts given and responded to.

Tosno.—On June 10th there was lanuched from the yard of Earle's Shipbuilding and Engineering Company, Ltd., Hull, the new steamer *Tosno*, which has been built to the order of Messrs. Thos. Wilson, Sons & Co., Ltd., for their passenger and cargo trade between Hull and St. Petersburg. This is a sister ship to the *Kovno*, which was launched from the same yard about two months ago. The vessel is 318 ft. in length, 41 ft. beam moulded, and 20 ft. 11 inches depth moulded, and has been built to British Corporation highest class and specially strengthened to withstand the severe wear and tear due to the large quantity of ice encountered in the Upper Baltic at the opening and closing of navigation. Her passenger accommodation is of a superior character, and combined with her quick steaming, should make her a favourite boat with those desirous of travelling to and from St. Petersburg. There is accommodation for twenty-four first-class passengers, the state-rooms being grouped amidships on the starboard side. Each room contains three berths. They are large, are well lighted and well ventilated, and are fitted with all modern appliances and conveniences. The lavatories and baths are *en suite*. The saloon runs parallel with the state-rooms on the port side, and leading from it there is a social hall. The latter is an innovation and will be used both by ladies and gentlemen. In bad weather particularly, or when the days are cold, it will be a delightful haven of refuge. The saloon and social hall are of handsome appearance. Both compartments are built of solid oak and set off in panels of an especially neat design, whilst the upholstery is of a sumptuous description. There is a very good promenade deck above the saloon house, well sheltered by the steel bulwarks, and an expansive poop deck will afford passengers further opportunities for promenading and for indulging in those games which are one of the pleasures of a voyage. The ship will be brilliantly lighted by electricity throughout, even to the masthead lights. The engines are triple compound, supplied by two large single-ended boilers fitted with forced draught on the closed ashpit system. The boilers work at 200 lbs. per square inch, and the steam is super-heated before passing into the cylinders to a temperature of about 500 degrees Fahr., thereby effecting a considerable saving in the coal consumption. The facilities for dealing with cargo are great, and weights up to 15 tons will be loaded and unloaded without the assistance of shore cranes.

Vittoria.—On June 10th Messrs. Richardson, Duck and Co. launched from their yard at Stockton-on-Tees a steel screw steamer of the following dimensions, *viz.*:—Length overall, 328 ft. 3 in.; breadth extreme, 46 ft. 6 in.; depth moulded, 23 ft. 30 in.; gross tonnage about 2850 tons. This vessel, which has been built to the order of the Scholefield Steam Shipping Co., Ltd., Newcastle-on-Tyne (Messrs. Hy. Scholefield & Son, managers), will take Lloyd's 100 A1 class and has been built under special survey. She is of the single-deck type with clear holds and has a cargo poop, bridge amidships, captain, officers and engineers being berthed in steel houses on bridge deck, and a topgallant forecastle for crew. A cellular double bottom all fore and aft and after peak tank are fitted for water ballast, and equipment includes five steam winches, large vertical donkey boiler by Blake, steam windlass with quick warping ends, stockless anchors, steam steering gear, etc. The engines by Messrs. Blair and Co., Ltd., have cylinders 23 in., 38 in., 62½ in. by 42 in. stroke, steam being supplied by two single-ended boilers having a working pressure of 160 lbs. The vessel during construction has been superintended by Mr. J. Baxter and Captain Temple, the owners' representatives. As the vessel left the ways she was christened *Vittoria* by Mrs. Arthur Scholefield, of Alnmouth, Northumberland.

Celtic.—On June 11th the steam fishing vessel *Celtic*, built to the order of Messrs. The Grimsby Steam Fishing Co., Ltd., was launched from the yard of Earle's Shipbuilding and Engineering Co., Ltd., Hull. The dimensions of the vessel are:—Length, 128 ft 4 in.; breadth, 22 ft. 3 in.; depth, 12 ft. 10 in. She is intended for the line fishing trade, and is fitted with a well amidships to enable her to carry live fish to the market. She has been built under Lloyd's survey for 100 A1 class steel and is provided with the usual trawling outfit. The vessel is constructed with a whale back forward to encounter heavy weather and provide a snelter for the deck hands. The machinery will consist of a set of triple-expansion engines having cylinders 12¾ in., 22 in., and 36 in. diameter, by 24 in. stroke, steam being supplied by a large single-ended cylindrical boiler working at a pressure of 180 lbs. per square inch. The naming ceremony was performed by Miss Kathleen Brown, Grimsby.

Lowenburg.—On June 11th a large steel screw steamer built to the order of the Deutsche Dampfschifffahrts Gesellschaft "Hansa," of Bremen, for their River Plate trade, was launched from the Neptune Shipyard of Messrs. Swan, Hunter & Wigham Richardson, Ltd., The vessel is about 400 ft. in length by 54 ft. beam, and will be fitted with powerful triple-expansion engines which, with the boilers, are also being built at the Neptune Works. S. T. Taylor & Sons have covered boilers, pipes, etc., with their "Tynos" non-conducting material, and boiler bottoms with their "Tynos" patent removable asbestos mattresses. Designed to attain the highest class in Lloyd's Registry, the steamer is a fine example of a first-class modern cargo boat, and is equipped with electric lighting and most complete auxiliary machinery, both for working the ship and for loading and discharging the cargo. A large company of visitors were present at the launch, when the christening ceremony was gracefully performed by Mrs. G. B. Richardson, wife of one of the directors of Swan, Hunter & Wigham Richardson, Ltd., the steamer being named the *Lowenburg*.

Morawitz.—On June 11th Messrs. Joseph L. Thompson and Sons, Ltd., of the North Sands Shipbuilding Yard, Sunderland, launched this steel screw steamer, which has been specially built to the order of Messrs. The "Atlantica" Sea Navigation Co., Ltd., of London and Budapest. The vessel has been built to Lloyd's highest class, under their special survey, on the three-deck rule, but with one deck laid, the principal dimensions being:—Length overall, 392 ft. 2 in.; breadth extreme, 52 ft. 3½ in.; depth moulded, 27 ft. 1 in., with long bridge, poop and topgallant forecastle. The deep frame system of construction has been adopted, leaving clear holds without obstruction by beams. Provision is made for water ballast in the cellular double bottom and in both fore and after peaks. The vessel is divided transversely by the usual water-tight bulkheads, and with additional wooden bulkheads. Special attention has been given to the loading and discharging facilities, fifteen of Lynn's steam winches being fitted, supplied with steam by a powerful marine-type donkey boiler, and a very complete derrick arrangement. The accommodation for the officers crew and spare cabins are commodious and will be handsomely fitted up. An electric light installation will be fitted throughout by Messrs. The Sunderland Fore and Engineering Co., Ltd., of Sunderland, and will include special arc lamps for working cargo at night time. The propelling machinery has been constructed by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, the sizes of the cylinders being 26 in., 42 in., 68 in. by 48 in. stroke, supplied with steam by two extra large boilers working at 180 lbs. pressure. The vessel was gracefully christened by Mrs. Robson, wife of Mr. D. M. Robson, of London, the company's superintendent, under whose supervision the vessel and machinery have been constructed.

Arizona.—On June 12th there was launched from the Southwick Yard of Messrs. Robert Thompson & Son, Ltd., the steel screw steamer *Arizona*, built to the order of Messrs. B. C. Atkinson & Son, of Middlesbrough. She is a sister ship to the *Wyoming* and *Idaho*, launched for the same owners in April, her principal dimensions being, length 176 ft., breadth 29 ft. 10 in., and depth moulded 13 ft., and is built to the highest class in Lloyd's. The erections consist of raised quarter deck, bridge amidships for the accommodation of officers and engineers, and topgallant forecastle for the crew. There are three large hatchways, worked by powerful steam winches by Clarke, Chapman & Co., Ltd., for the rapid loading and discharging of cargo, quick warping steam windlass by Emerson, Walker & Thompson, Bros., Ltd., and steam and hand steering gear by Messrs. Robert Roger and Co., Ltd. The engines are by Messrs. Richardson, Westgarth and Co., Ltd., of Middlesbrough, of the triple-expansion type, having cylinders of 15½ in., 25 in. and 41 in. by 27 in. stroke, with two boilers of ample power. During construction the ship and her machinery have been personally superintended by Mr. James Summers, of Middlesbrough. The christening ceremony was gracefully performed by Miss Olga Atkinson, daughter of the senior partner.

Kronprins Olav.—On June 12th Sir Raylton Dixon and Co., Ltd., launched from their Cleveland Dockyards, Middlesbrough, a steamer built with cantilever frames on Harroway and Dixon's, John Priestman's and Livingston and Sanderson's patents to the order of Consul Johan Bryde, of Sandefjord, Norway. She is being built to highest class at Norske Veritas, her leading dimensions being 372 ft. 2 in. by 52 ft. by 28 ft. 4 in. moulded, and she will carry a deadweight cargo of about 7000 tons on 22 ft. 1 in. draught with eight hatchways 30 ft. wide and perfectly self-trimming and unobstructed holds. The vessel will be equipped with ten powerful steam winches, ten derrick posts with double derricks at each, hand and steam steering gear, and will have six water-tight bulkheads, four boats, etc., and all the latest and most modern appliances for the rapid handling of cargo. In addition to this the vessel will carry an unusually large quantity of water ballast located under the deck in top side tanks as well as in double bottom and peaks. She will be fitted with engines placed aft by the North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 26 in., 42 in., 70 in. by 48 in. stroke, supplied with steam by three large single-ended boilers working at 180 lbs. pressure, and fitted with Howden's system of forced draught. On leaving the ways she was gracefully named *Kronprins Olav* by Mrs. Bryde, wife of the owner. The vessel and her engines are being constructed under the superintendence of Captain P. A. Neilsen.

Investigator.—On June 11th a screw steamer of special design was launched from the yard of Vickers, Sons and Maxim's, Ltd., Barrow-in-Furness. The vessel, which was built to the order of the Indian Government, for whom the Vickers Co. have already constructed several important and well-armed ships, was designed by the late Sir Edward Reed, who was for so many years the consulting naval architect and marine engineer of the Indian Government, and the construction has been supervised by Prof. J. H. Biles since his appointment as Sir Edward's successor. The launching ceremony was performed by Miss Burls, daughter of the Director-General of Stores at the India Office, Mr. E. Grant Burls. The principal dimensions of the *Investigator* are as follows:—Length on load water line, 204 ft.; breadth moulded, 33 ft.; depth moulded to main deck, 15 ft. 3 in., depth to awning deck, 22 ft. 9 in.; dis-

placement, 1180 tons; mean speed, 13 knots; indicated horse power, 1500. The vessel was designed and has been built for survey work in Indian waters. She is of the awning deck type with a clipper stern and elliptical stern, and has two schooner rigged masts and one funnel, and so when complete will have an exceptionally smart appearance. The steel scantlings are according to Lloyd's highest class. The officers have their accommodation on the main deck forward, and the warrant officers and crew aft. On the awning deck forward of the boiler casing a large deck house is fitted to form a room for plotting out charts, and forward of this house on deck there is a Lucas sounding machine, suitable for depths up to 5000 fathoms. The vessel can be steered by hand and steam from a steering house aft on the awning deck, the steam gear being controlled from the bridge by a telemotor. A complete installation of electric light is fitted, and there are electric fans in cabins. There are nine small boats, two of which are steam cutters. The vessel is propelled by a set of direct-acting vertical engines, capable of developing 1500 I.H.P. The three cylinders are of the following diameters—H.P., 21 in.; I.P., 33 in.; L.P., 53 in., each adapted for a stroke of 33 in. The two boilers are of the double-ended cylindrical type constructed for a working pressure of 180 lbs. per square inch. An auxiliary boiler of the vertical type is also fitted for supplying steam to the various auxiliary engines when the vessel is in port. The condensers are cylindrical, made of rolled naval brass, and are placed at the back of the engines. In addition to the usual feed and bilge pumping engines, the vessel is fitted with evaporating and distilling plant, fresh water pumps, feed water heaters and filters and silent ash hoists and apparatus for discharging ashes overboard in the usual manner.

Delia.—On June 22nd Messrs. Wood, Skinner & Co., Limited, of Bill Quay, Newcastle-on-Tyne, successfully launched from their shipbuilding yard a new steel screw steamer which has been built by them to the order of Messrs. the Dampfschifffahrts Gesellschaft "Neptun," Bremen, Germany. The vessel is a sister ship to the s.s. *Hestia*, recently constructed by the builders for the same owners, and is of the raised quarter deck type with bridge and topgallant forecastle. Water ballast is provided in the cellular double bottom all fore and aft and in the peak tanks. The saloon, captain's accommodation, etc., is arranged in a large house on the bridge deck, the officers and engineers being berthed in sidehouses on the after end of the bridge, and the crew in the topgallant forecastle. She will be rigged as a two-masted schooner and will be fitted with every improvement and appliance for facilitating the rapid loading and discharging of cargo. The machinery, which is of the improved triple-expansion type, has been constructed and will be fitted by Messrs. The North-Eastern Marine Engineering Company, Limited, at their Southwick Engine Works, Sunderland. Both the ship and engines have been built to the requirements and under the special survey of Lloyd's for their highest classification, and have also been superintended during construction by Mr. S. Siemens on behalf of the owners. As the vessel left the ways she was gracefully named *Delia* by Miss Mason, daughter of Mr. Robert Mason, of Messrs. L. S. Carr & Co., of Newcastle-on-Tyne, the English agents for the owners.

LAUNCHES—Scotch.

Espana.—On May 24th Messrs. Wm. Simons & Co., Ltd., launched from their yard at Renfrew, a self-propelling bucket ladder dredger which they have constructed for a Spanish port. The dredger is of the bow well type and is designed for cutting its own flotation and down to a maximum depth of 40 ft. below water level. Propelling and dredging power is supplied from one set of compound surface condensing engines, the necessary arrangements being provided for engaging the engines to and from the propeller and dredging gear. The buckets have a nominal dredging capacity of 450 tons per hour, and are of strong construction for dredging hard material. Steam manœuvring winches are provided at bow and stern for regulating the dredging operations. The barrels of these winches may be wrought separately or conjointly as circumstances require. Steam is supplied to the main and auxiliary engines from a steel boiler of Scotch type constructed for 120 lbs. working pressure. An auxiliary condenser is fitted up in the engine-room and a special pump is employed for flushing the shoots. The dredger, which is named the *Espana*, is classed at Bureau Veritas, and was built under the survey of this society.

Miranda.—On May 31st the *Miranda*, the first of the three cargo and passenger steamers building by Messrs. Mackay Brothers to the order of Messrs. Fry, Miers & Co., London, for the Lloyd Brazileiro was launched at Alloa. The vessel has been specially designed to carry her deadweight on a shallow draught, with twin-screw engines by Messrs. Aitchison, Blair & Co., Clydebank, for a 10-knot speed. The dimensions are 235 ft. by 36 ft. by 12 ft., and the vessel is classed with the British Corporation. Cockran (Annan) donkey boiler with patent seamless furnace has been fitted.

Portugalate.—On May 31st Messrs. Wm. Simons & Co., Ltd., Renfrew, launched complete, with all machinery on board, and with steam up ready for trials, the first of two 800-ton hopper steamers which they have on order for a Spanish port. The vessel is propelled by one set of compound surface condensing marine engines, supplied with steam from a mild steel horizontal multitubular boiler, constructed for a working pressure of 120 lbs. per square inch. Powerful steam gear is provided for rapidly raising and closing hopper doors. Comfortable quarters are provided for the officers and crew. The vessel is named *Portugalete*, and has been built under the survey of Bureau Veritas for classification in their registry.

Tabaristan.—On June 15th there was launched from the Shipbuilding Yard of Messrs. David and William Henderson and Co., Ltd., Partick, Glasgow, a steel screw steamer of the following dimensions:—Length, 390 ft.; breadth, 46 ft.; depth moulded, 27 ft., which they have constructed to the order of Messrs. Frank C. Strick & Co., Ltd., London. The vessel, which has been built to class 100 A1 in Lloyd's Registry, strengthened spar-deck class, with poop, bridge and forecastle, will have a gross tonnage of about 4000 tons, and has been specially designed to suit the owners' trade. In addition to the usual double bottom fore and aft for water ballast, a deep hold tank for carrying water is also fitted. Saloon, state-rooms, captain's, officers' and engineers' rooms are in houses on bridge deck, whilst the crew are berthed in forecastle. Vessel will have two pole masts, be rigged as a fore and aft schooner, and is replete with everything that can be of assistance in the rapid handling of cargo, including nine powerful steam winches. The machinery, which has also been constructed by Messrs. Henderson, consists of a set of triple-expansion engines and four single-ended boilers working at a pressure of 180 lbs. per square inch. The hull and machinery have been constructed under the supervision of Mr. Archd. Walker, the owners' superintendent, assisted by Mr. Matthews. The ceremony of naming the vessel *Tabaristan* was gracefully performed by Miss Yvonne Kinghorn, Burnside.

Alexandra.—One of the most interesting items contributing to the abnormal output of tonnage sent off Clyde stocks during May—although in the matter of size of only trifling moment—was the turbine yacht *Alexandra*, built for the use of His Majesty King Edward by the firm of A. & J. Inglis, Pointhouse Shipyard, Glasgow, and launched from their yard on Thursday, the 30th May. The event naturally excited in the minds of Clydeside residents, and over a much wider area, deep interest, and it was witnessed by a large concourse of spectators. The naming ceremony was performed by Princess Louise, Duchess of Argyll, who, with her husband, the Duke; had a very appreciative welcome. Destined as the *Alexandra* is to serve as the floating home of one so high in station as the King, the foresight, care, and skill expended in the vessel's design and construction have been exceptional, or at least adequate to the high demands of the work. The surveillance, as Dr. Inglis on the occasion of the launch hinted, has been strict and rigid, and progress with the vessel has been leisurely. The Inglis firm—of whom Dr. John Inglis is principal—secured the contract to build the yacht in March, 1905. They did so in competition with a number of other shipbuilding firms, each of whom submitted a model and plants of the yacht they suggested. The various firms tendering were not handicapped in any way by stipulations or plans, but were left very much to their own discretion in the planning of the vessel, except that they were informed of the general dimensions and the draught that was required. They were given

to understand that the yacht was to be considerably smaller than the *Victoria and Albert*; that she was to be of a draught sufficiently light to enter ports into which the larger vessel cannot go—such, for instance, as Flushing and Nice; that she was to be fitted up, not for larger parties of guests, but for the Royal Family and their private suite, and that she was to have turbine machinery. A new feature in the competition for the contract was that in each case the designs submitted contained only a motto, the name of the firm and the tender being enclosed in a sealed envelope, so that the designs were dealt with entirely on their merits, and without considerations of origin or price. Messrs. Inglis's designs, it is understood, were picked out very early in the proceedings as especially suitable, and when the Admiralty Committee, which included Admiral Sir John Fullerton, Admiral Sir A. Berkeley-Milne, and Sir Philip Watts, Director of Naval Construction, recommended them to the King, they met with His Majesty's unqualified approval. The new yacht, while replacing the *Osborne*, which is no longer fit for service, is to serve as an auxiliary rather than as a substitute for the *Victoria and Albert*, built in 1899. Being 137 ft. shorter than the last-named vessel, and in consequence of a much lighter draught of water and less than half the tonnage, the new yacht will be preferred for most purposes. She is 275 ft. long on the water line, 300 ft. over all, and has a beam of 40 ft. with a depth to upper deck of 23 ft. and a normal draught of water of 12 ft. 6 in. At this draught she is expected to displace 2050 tons. She has a topgallant forecastle, also a bridge deck, 150 ft. in length, which affords a sheltered promenade. The pavilion or deck house which this bridge deck covers contains the reception-room, dining-room, and pantry, while abreast of it there are two small boudoirs which have a clear view ahead and astern and also over each side. The King's smoking-room is under the bridge, and also rooms for the commander of the vessel, the officers, and the surgeon, as well as the ship's hospital or sick bay On the main deck abaft the turbine-room are the Royal apartments, and rooms for His Majesty's secretary, equerries and others. The arrangements for the accommodation of officers, crew and servants generally, as well as the cuisine and other features of the King's floating home, are, as may be supposed, of a well-devised description. The principal cabins will be decorated by Waring & Gillow, London, and the yacht throughout is being fitted with electric light by Claude, Hamilton & Co., Glasgow. The turbine machinery of the *Alexandra* which, as is well known, is being made by the Parsons Co., Wallsend-on-Tyne, is designed to develop 4500 H.P. and give the vessel a speed of about 18¼ knots. The three-shaft arrangement, now almost invariably adapted in turbine propelled vessels, also obtains here. Of the three turbines that on the centre line of shafting is high pressure, the two side turbines being low pressure, while reversing turbines are incorporated in the exhaust casing of each of the latter. Special attention has been given in the design of the main features to secure accessibility and convenience in the overhaul of parts, both main and accessory, with the least possible disturbance of the general arrangements. Special pumps for forced lubrication for the bearings, with all the latest fittings for the control of the flow of oil through the bearings, are fitted, while a special independent oil cooler and oil and feed filter are also provided. The Parsons patent vacuum augmenter and its accessories, for the securing of the high vacuum desirable, are also fitted. The starting and operating valves are on a level with the turbines, thus affording the engineer in charge a full view of the engine-room and its vital features. One valve only is employed for starting, and the two manœuvring valves—that is to say, one for the pressure ahead, and the other for the astern motion—are combined and operated by one handle. Steam is supplied from three Yarrow water-tube boilers, the products of combustion being carried off through two funnels. There will be three masts and a modified three-schooner rig, with the time-honoured and graceful cut-water stem and bowsprit. The steam steering gear on the vessel is by John Hastie & Co., Greenock. The *Alexandra* is the first Royal yacht designed from the foundation and specially built for turbine machinery, the only other existing Royal yacht is the *Mahrousse*, formerly a paddle steamer, which, it will be remembered, the Inglis firm renovated and supplied with Parsons turbines of their own manufacture last year for His Highness the Khedive of Egypt. Presiding at the luncheon after the launch, and replying to the toast of his health Dr. Inglis stated that the *Alexandra* was the first Royal yacht ever built in a private establishment, and there might be permitted to his firm a certain feeling of elation at having been chosen for that most important contract. Speed and comfort at sea to the Sovereign and Royal Family were matters of national concern. On their own merits, however, modest men were dumb, and he did not propose to suggest a reason why his firm had been selected to build the Royal yacht. Skill in shipbuilding was pretty generally diffused in this country. No individuals, firms, nor districts could claim a monopoly. But not every ship-builder had directed his attention to that particular branch of his art, and when it came to designing and building large steam yachts the choice of experienced builders was somewhat restricted. He and his colleagues, and their staff, had spared no possible effort to justify the confidence that had been reposed in them. They had had to work under a system of inspection that was perhaps necessary, but was certainly rigid. Notwithstanding this it had been carried through with practically no friction. He was convinced that in the *Alexandra* His Majesty would have a strong, speedy and seaworthy pleasure cruiser. Other toasts fitting to the occasion, concerned with the Princess Louise, the Duke of Argyll and the Admiralty representatives present, were also given and duly honoured.

LAUNCHES—Irish.

Whakarua.—On May 30th Messrs. Workman, Clark and Company, Limited, Belfast, launched from their North Yard the first of two steamers being built and engined by them for Messrs. The Tyser Line, Limited, London. The *Whakarua* is 446 feet in length with a gross tonnage of about 6500, and has been built under Lloyd's survey for the highest class in their registry. The new steamer is of the shelter deck type and has three complete steel decks extending all fore and aft. The cargo space is divided into five large holds, three of these being insulated and prepared for the reception of frozen meat cargo, for the preservation of which a very complete refrigerating installation has been fitted. Each of the holds is provided with a large hatchway equipped with a couple of powerful steam winches and the necessary derricks for expeditiously dealing with a large general cargo; the derricks being swung from the masts and special derrick posts. On the shelter deck amidships a large central house has been erected, and in the fore end of this house a number of passengers' state-rooms have been fitted up on each side of the dining saloon. The officers' and engineers' rooms are placed at the after end and at each side of the deck house, while the captain's room is in a steel house on the bridge deck. The crew's quarters have been arranged on the upper deck forward. The propelling machinery consists of two sets of direct-acting tri-compound engines with all the most modern auxiliary appliances, supplied with steam from four single-ended multitubular boilers working under Howden's system of forced draught. The construction of the vessel has been carried out under the supervision of Mr. John Esplen, of Liverpool, and Mr. Wm. Swainston, of Messrs. Esplen, Son & Swainston, London, in the interests of Messrs. The Tyser Line, Limited.

São Paulo.—On June 14th Messrs. Workman, Clark and Co., Limited, Belfast, launched from their South Shipbuilding Yard the third steamer built by them for the fleet of the Lloyd Brazileiro of Rio de Janeiro. The interesting function was carried out in the presence of a distinguished company representing the owners and builders, among those present being Conselheiro Dr. Francisco de Paulo Rodrigues Alves, Mlle. Marietta Rodrigues Alves, Mlle. Rodrigues Alves, Dr. Manuel Buarque, Dr. Carlos Buarque, Captain Vidal de Oliveira Freitas, Dr. Jose Rodrigues, junr., Dr. Paul Regis de Oliveira, Dr. Oscar de Aranjo, Dr. Carlos Sampaio, Commander Armando Burlamaqui, Senhora Burlamaqui, Captain Rosauro de Almeida, Captain Pacheco de Carvalho, Mr. Williames, Miss Williames, Captain Hicks, Mr. Baker, Mr. Frank Workman, Mr. Bates, Mrs. Bates, Mr. Wimshurst, Mrs. Wimshurst, Captain Willington, Mr. Hudiz. The principal guests were photographed on a platform erected specially for the launch. The ceremony of christening and

launching the vessel was gracefully performed by Mlle. Marietta Rodrigues Alves, the daughter of Conselheiro Dr. Francisco de Paulo Rodrigues Alves, who named the vessel *Sao Paulo*. The most complete arrangements had been made for the launch, and the proceedings passed off in a highly successful manner, the vessel, after being set in motion by the pressure of an electric button on the rail of the platform, slowly and gracefully glided down the ways and entered the water amid the cheers of the spectators accompanied by the whistling of syrens and the booms of signal guns. The usual sombre aspect of the works was for the time being relieved by a tasetful display of gaily-hued bunting, which included various national flags, prominence being given to that of the Brazilian Republic. The *Sao Paulo* is 356 ft. in length with a gross tonnage of over 3700, and has been built under Lloyd's special survey to qualify for their highest class, besides fulfilling the Board of Trade requirements for a foreign-going passenger steamer. The vessel has been specially designed and arranged to suit the requirements of the passenger and general cargo trade between the nations of the American continent. The arrangements of all the private and public rooms embrace the very latest ideas for ensuring the comfort of the travelling public. Accommodation is provided for over fifty first-class passengers, twenty-five second-class and over three hundred third-class. The first-class passengers rooms are placed in a large house on the bridge deck and are all airy and well-lighted apartments, arranged for one, two and three persons. At the forward end of this deck-house a large entrance hall with music-room adjoining has been arranged. The entrance hall is fitted up as a lounge, and the music-room is a most luxuriously furnished apartment. At the after end of the bridge deck a wide stairway leads up to the smoke-room on the boat deck. This room is very lofty and well lighted, and has an alcove built on the deck at the after end, in which passengers can lounge under shelter in the open air. The boat deck affords ample space for safe and comfortable promenading. The dining saloon on the upper deck is a spacious and well-lighted apartment extending the full width of the vessel, and is approached from the entrance hall by a handsome wide staircase. The second-class passengers are accommodated in a steel house on the poop deck, at the forward end of which a large dining saloon is provided, the state rooms opening off the deck, thus ensuring efficient ventilation. The steerage quarters have been arranged on the poop and on the main deck, and include a separate room for women, all these spaces being fitted up with iron beds. The captain's and officers' rooms are placed in a house on the boat deck, while petty officers and engineers are berthed in side houses at the after end of the bridge space, the crew being quartered in the top-gallant forecastle. Throughout all the accommodation special attention has been given to the efficient ventilation of all living spaces, both by natural and artificial means. The sanitary arrangements for each class has also received very careful consideration and will be found to be of the most satisfactory character. The cargo space of the vessel is divided into four holds, each of which is provided with a large hatchway equipped with powerful steam cranes, capable of rapidly loading and discharging cargo. One of the 'tween deck cargo spaces has been insulated and prepared for the reception of perishable cargo, and also contains chambers for provisions, vegetables, etc., for the requirements of passengers during the voyages; for the preservation of this cargo and stores an efficient refrigerating plant has been installed. Electric lighting will be fitted throughout the vessel. The propelling machinery consists of two sets of triple-expansion engines with three steel cylindrical multi-tubular boilers working under Howden's system of forced draught, all constructed in Messrs. Workman, Clark & Co.'s Queen's Road Works. The designing and construction of the vessel and machinery have been carried out with the co-operation and under the superintendence of Dr. Rosauro de Almeida, Commander-Engineer of the Brazilian Navy, who is the Technical Director-in-Chief for the Lloyd Brazileiro. After the launch the guests made an inspection of the ship yard and works, and were afterwards entertained to lunch in the directors' room at the engine works, the apartment being beautifully adorned with flags and tropical plants. A beautiful model of the *Sao Paulo* as she will appear when completed and ready for sea was on view at one end of the apartment, and was greatly admired by the visitors.

TRIAL TRIPS.

Terawhiti.—Lately the powerful new tug and salvage steamer *Terawhiti* (of which we gave particulars in our May issue, page 386), built by Ramage & Ferguson, Ltd., Leith, for the Union Steamship Co. of New Zealand, Ltd., has completed her trials on the Firth of Forth, when a speed of over 12 knots was obtained during a six hours' run. The machinery during the trials worked smoothly. The *Terawhiti* has sailed for Wellington, New Zealand, *via* the Suez Canal.

Benin.—On May 24th the s.s. *Benin*, which has been built by Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, for Messrs. Elder, Dempster & Co., for their West African trade was taken out to sea for her trial trip. The vessel is of the following leading dimensions:—Length overall, 386 ft.; beam extreme, 47 ft. 3 in.; depth moulded, 30 ft. 8 in. to spar deck. The vessel carries a deadweight cargo of 7170 tons on a draught of 24 ft. 11 in. The machinery has been constructed by the North-Eastern Marine Engineering Co., Ltd., Wallsend, and consists of a set of triple-expansion engines having cylinders 25½ in., 42 in., 70 in. by 48 in. stroke, steam being supplied by two large single-ended boilers 15 ft. 9 in. by 11 ft. 9 in., working at 180 lbs. pressure and fitted with Howden's forced draught. On the trial trip a speed of about 12 knots was attained.

Ocean Prince.—On May 26th the s.s. *Ocean Prince*, which has been built by Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, for the Prince Line, Ltd., was taken out to sea for her trial trip. The vessel is of the following leading dimensions:—Length overall, 412 ft. by 50 ft. 2½ in.; beam extreme, by 32 ft. 3 in., depth moulded to upper deck. The vessel carries a deadweight cargo of 8280 tons on 25 ft. 10 in. The machinery has been constructed by the North-Eastern Marine Engineering Co., Ltd., Wallsend, and consists of a set of triple expansion engines having cylinders 27 in., 45 in. and 74 in. by 48 in. stroke, with three large single-ended boilers and fitted with Howden's forced draught. On the trial trip the vessel attained a speed of about 12 knots.

Waihora.—On May 27th the s.s. *Waihora* (of which we gave particulars in our May issue, page 385), built for the Union S.S. Co. of New Zealand, Ltd., at the Neptune Works of Swan, Hunter & Wigham Richardson, Ltd., went for a very successful trial trip, attaining a speed of over 12 knots per hour. On the trial trip the engines worked without the slightest hitch, giving satisfaction to all concerned. The owners were represented by Mr. J. R. Campbell, of Glasgow, their naval architect, and Mr. Paterson, under whose superintendence the vessel has been built.

Idaho.—On May 29th the s.s. *Idaho* (of which we gave particulars in our June issue, page 422), the second of three sister ships built by Messrs. Robert Thompson & Sons, Ltd., Southwick Yard, Sunderland, for Messrs. B. C. Atkinson and Son, of Middlesbrough, was taken out to sea for her official trial. A speed of over 10 knots was easily attained, and Mr. Summers, on behalf of the owners, expressed himself highly satisfied with the vessel and smooth working of the engines. Messrs. S. T. Taylor & Sons have covered boilers, etc., with their "Tynos" non-conducting material.

Chikugo Maru.—On May 31st and June 1st the s.s. *Chikugo Maru* (of which we gave particulars in our May issue, page 385), built by Messrs. David & William Henderson & Co., Ltd., at Partick, to the order of the Nipon Yusen Kaisha, Japan, through Messrs. A. R. Brown, Macfarlane & Co., Ltd., Glasgow, and under whose inspection the vessel was built, underwent successful trials on the Firth of Clyde. On May 31st the speed trials were run, and a mean speed of 15¾ knots was easily attained. On the following day the coal consumption trials passed off successfully, and everything was highly satisfactory to the owner's representatives and builders. Messrs. S. T. Taylor & Sons have covered main and donkey boiler bottoms with their "Tynos" patent removable asbestos mattresses.

Anine.—On June 1st the fine new steel screw steamer *Anine*, built by Messrs. Wood, Skinner & Co., Ltd., of Bill Quay-on-Tyne, to the order of Mr. Martin Carl, of Copenhagen, left the Tyne for her official trial trip. This vessel is of the single

deck type with poop bridge and topgallant forecastle, and has specially large hatches for self-trimming. She is fitted with all improvements and appliances for facilitating the rapid loading and discharging of cargo and general working and navigation. The propelling machinery, which has been constructed and fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple expansion engines, having cylinders 17½ in., 29 in. and 48 in., with a stroke of 33 in., steam being supplied by a large steel boiler working at a high pressure. During the run the weather was very unfavourable, but the vessel ran without a hitch, the engines working very satisfactorily and maintaining a speed of about 12 knots, which gave satisfaction to all concerned. Amongst those present were Mr. Leslie Skinner, representing the shipbuilders, and Mr. D. Myles, representing the engine builders.

Yarra.—On June 1st the s.s. *Yarra*, of which we gave particulars in our May issue page 384), built by Messrs. Furness Withy & Co., Ltd., Hartlepool, to the order of Messrs. Huddart, Parker & Co. Proprietary Limited, Melbourne Australia, proceeded on her official trial trip from the Tyne to Whitby High Light and back, and attained a speed of 9¼ knots loaded. The machinery worked exceedingly well throughout the trial, and has been supplied by Messrs. Richardson, Westgarth & Co., Ltd., Hartlepool. Mr. W. Cumming and Mr. R. Oxford represented the owners, Mr. H. Withy the ship-builders, and Mr. L. D. Wingate the engine builders. The vessel proceeded straight to Melbourne under the command of Captain South.

Betty. On June 3rd the powerful new steel screw tug *Betty* ran her official trial on the river Thames. This vessel is 82 ft. long and 22 ft. 9 in. extreme breadth is fitted with triple expansion engines and a boiler working at 180 lbs. pressure and has been specially designed and constructed by James Pollock, Sons & Co. Ltd. of London for coping with the heavy and increased barge traffic between Tilbury Docks and London. There are many special features in the hull and machinery to facilitate handling in the crowded waters between the Pool and London Bridge; steam towing gear, electric searchlight and powerful deck lights, salvage pumps for pumping out vessels, etc. Messrs. Pollock have at present under construction nine other tugs, of which they make a speciality, two for the river Thames, three for South America and one for the Nile.

Dan. On June 6th the new screw steamer *Dan*, of which we gave particulars in our June issue page 422), built by Messrs. Joseph L. Thompson & Son, West Docks, South Shields, to the order of Messrs. Consuming Investment & Partners, Dublin, was taken to sea on her official trial trip, which was in every way satisfactory to all concerned, and the vessel afterwards returned to the Tyne to take on cargo, which she will sail for Trieste under the command of Captain Krunapeve. Among the company present were Mr. Giovanni Rusch, Mr. N. Bonez, Mr. John Rusch, Mr. Hunt and Mr. Rusden, representing Austrian Lloyds. Captain Krunapeve, etc. This is the fourth vessel built for Messrs. Rusch by the above firm.

Navarra. On June 6th the new steamer *Navarra*, built by Messrs. William Dobson & Co., Walker, for Messrs. Fearnley & Eger, Christiania, was taken to sea for her trial trip. The vessel is 332 ft. long, 46 ft. beam, and 28 ft. 2 in. depth moulded, the deadweight carrying capacity being over 2100 tons on a light draught of water. The machinery, which has been constructed by The North-Eastern Marine Engineering Co. Ltd. Wallsend, consists of a set of triple expansion engines with cylinders 18 in., 30½ in. and 49 in. diameter and 33 in. stroke, with one large boiler, 180 lbs. pressure. The speed obtained on the measured mile was upwards of 10 knots, and after the trial the vessel proceeded to Blyth to load a cargo for Stockholm.

Despina G. Michalinos.—On June 7th the handsome steel screw steamer *Despina G. Michalinos* (of which we gave particulars in our June issue, page 422) had her trial trip. She has been built by Messrs. Wm. Gray & Co., Ltd., for Messrs. Michalinos & Co., of London and Piræus. A very successful run was made round to the Tyne, where the vessel loads, the average speed being 10½ knots.

Annette Furness.—On June 8th Messrs. Osbourne, Graham and Co. sent to sea for her official trip the steel screw steamer *Annette Furness* (of which we gave particulars in our June issue, page 422), which has been specially constructed for the International Steamship and Salvage Co., Ltd. (Messrs. A. & H. Christensen, managers), of Aarhus, Denmark. During the trial everything was satisfactory, a speed of over 10¾ knots being easily attained. Cochran (Annan) donkey boiler with patent seamless furnace has been fitted.

Ellen.—On June 12th the steamer *Ellen* (of which we gave particulars in our June issue, page 421), built by Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyards, Middlesbrough, with cantilever frames on Harroway & Dixon's, John Priestman's and Livingston and Sanderson's patents to the order of Herr P. A. Gron, of Sandefjord, Norway, proceeded to sea for her official trials, which passed off most successfully, and the steamer under the command of Captain Olsen proceeded in ballast direct to Sydney, Nova Scotia, under charter of the Dominion Coal Co.

Agnes.—On June 11th the new steel screw tug *Agnes* ran her official trial on the river Thames; she is one of many tugs specially designed and constructed by Messrs. James Pollock, Sons & Co., Ltd., of 3, Lloyd's Avenue, London, for work on this river. This particular craft is an addition to the fleet of the Thames Tug and Lighterage Co., Ltd., London, and the principal dimensions are: Length, 70 ft.; breadth, 18 ft.; depth, 9 ft. 11 in., and is fitted with compound surface condensing engines, and a large return tube boiler working at 130 lbs. pressure. The rapid handling qualities are proved by the fact that a complete circle is attained in one minute, ten and three-quarter seconds, and from full speed ahead the tug can be brought up to a head stop in twenty-two and a half seconds, and from full speed astern in ten seconds.

The Contract for the structural steel buildings for the gas-producer and boiler-houses, along with the coal conveyors, elevators, overhead storage bunkers and accessories for the new branch of the Clarence Steel Works, now being erected on the Manchester Ship Canal, has been placed with the Gilbert Little Co. Ltd., Bradford.

Mr. James A. Smith, M.I.N.A., of 47, Leadenhall Street, E.C., has received an order for a 5½-ton sea-going auxiliary yacht. She will have a 4-6 h.p. Fairbank's motor, and will be sloop-rigged and fitted up for comfortable sea cruising; the keel has been laid by Messrs. Gill & Sons, Rochester. Other orders which Mr. Smith has in hand include *Dolcemono*, Mr. Mall Green's new river cabin cruiser, which is now running trials with her Blake motor at Messrs. Gill's, her builders. Capt. Posgate's 7-ton centre-board cruiser *Will o' the Wisp* has been completed by Mr. Olley, at Strood, and will soon be ready for use. The Riverside Works Co., Weybridge, are building a 32-ft. motor towing launch to Mr. Smith's order, which is now in frame, she is of teak, elm and oak throughout, and is completely decked, being designed for heavy towing work and fitted with a 30 h.p. Gardner motor, Gardner reverse and Gaines solid propeller. Another interesting design is a 50-ton sea-going steam launch, building at the Rowhedge Ironworks Co.'s yard, Rowhedge; this vessel is of steel of the steam yacht design and finish throughout and will have C.S.C. machinery of 170 I.H.P. Her dimensions are 66 ft. o.a. by 13 ft. 6 ins. The Bergius Car and Engine Co., of Glasgow, have completed or in hand six 25-ft. launches to Mr. Smith's designs, fitted with Kelvin motors. A number of designs are also on the boards for the Phœnix Motor Co., of Altrincham, of which the first, a 25-ft. racing launch, is being built at Glasgow. The new motor ferry-boat for Teignmouth is under construction and the order for the motor has been placed with the Mitcham Co. Mr. Anargyro's 50 h.p. fast launch *Ægolis* has been delivered in Greece by her builder, Mr. F. Maynard. Mr. Hill-Dawe's 20-ft. yacht's launch has been completed by Mr. H. Milham, at Twickenham. Complete building plans and specifications have also been delivered by Mr. Smith for an 18-ton auxiliary yacht with a 30 h.p. Parsons motor, an 8-ton fast sea-going auxiliary, with a 30 h.p. Simms motor, both with Gaine's propellers, and a 38 ft. river cabin launch with two 6 h.p. Blake motors; these vessels, with Mr. Nielsen's 100 h.p. fast cruiser, also designed recently, are to be put in hand for next season.

Soap.—The introduction of a new industry or a change in the mode of living in a community tends to the creation of other industries and occupations, thus widening the area of the field in which man can labour to earn, by his inventive genius or by the work of his hands, sufficient for his luxurious desires or his necessities. The general public is inclined to look upon changes with a severely critical eye and does not readily accept innovations with equanimity, hence the motor car and 'bus are by no means popular, while the motor cycle with its hideous noise is likened unto an abomination—one has just passed along at the moment of writing—which will, it is hoped, soon be banished into the limbo of a past, where memory alone will raise a passing shudder. The necessity for neatness and cleanliness is all the more important when it is considered that redeeming features have to be made prominent to disarm the carping criticism which sets down the motor and its attendant as something to be endured at as safe a distance as possible. The need of a good cleanser to remove the grime and greasy deposit which gathers on and around the digits of those who handle, overhaul and make good the machinery of the motor is an important element of detail, and to meet this several firms have set themselves to the task of presenting to the market a soap which will remove expeditiously and without injury to the skin, the oily accumulation inseparable from working with machinery. These special soaps are not only preferable, but better adapted for the purpose than the ordinary or the black soft soap frequently used—preferable on account of the odour, better by reason of their cleansing properties. After a dirty job in the engine room or stokehold, the inspection of machinery and especially of boilers, when the grime sticks like glue, the necessity of a good cleanser is appreciated, and we are informed by some of our readers that these special soaps are in use, but only to a small extent, chiefly because they are not sufficiently known in the engine room and engine shop. From our own experience, we can endorse the view that some of the soap tablets specially manufactured for removing greasy grime from the hands are exceedingly grateful and more to be desired than the ordinary, besides saving the clean oil sometimes surreptitiously used. Among the firms who have succeeded in producing a soap which goes out to meet the requirements of those whose duties lead them amongst machinery to the extent of actual contact with the oil or grease and grime, may be mentioned the well-known Messrs. F. S. Cleaver & Sons, whose sample has just reached our hands in time for a trial, and the test having proved satisfactory, we can give this "Antioyl" motor soap a good recommendation, as a capital cleanser, smooth in its action on the skin and a desirable addition to a boiler suit equipment.

The Ostasiatiske Kompagni (The East Asiatic Co.), of Copenhagen, is adding to its fleet by the purchase of steamers from British owners. The *Avoca* has recently been taken over for emigration service, after being specially surveyed by representatives of the company when in dry dock at Newcastle-on-Tyne. The *Avoca* was built by Messrs. Denny Bros., Dumbarton, in 1891. She has tandem quadruple expansion engines with cylinders 32 in., 46½ in., 64½ in. and 92 in. by 60 in. stroke; three double-ended boilers of 180 lbs. pressure and is fitted with hydraulic cargo gear, including windlass and stearing by Messrs. Brown Bros., Edinburgh.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class; 2C Second Class.

May 25th, 1907

Adams, Wm. F. 2C W. Hart'l
Alexander, W 1C Glasgow
Anderson, R. L. 2C Cardiff
Barrow, R S R 2C London
Blease, Wm. J 2C Liverpool
Blower, A. H. . 2C Liverpool
Borthwick, G. B 1C Leith
Boyd, J. T. M. . 2C London
Carruthers, D.A. 2C Glasgow
Chimmo-land, W. H 1C London
Clark, Jas. H 1C London
Cockburn, H. N 1C Glasgow
Cordiner, W. B 2C South'ton
Cornick, Thos. . 1C Glasgow
Coulson, Rich. 2C N Shields
Crawford, E. O. 2C W. Hart'l
Cudlipp, A. B. . 2C Cardiff
Dimminck, Jos. 2C Glasgow
Ellis, Charles .. 2C London
Ferguson, R. P. 2C Liverpool
Fillsell, Clark .. 2C London
Gilmour, C. .. 1C Glasgow
Grant, Albert E. 2C N Shields
Ham, Thos G. 2C Barrow
Howard, L. W. 1C Glasgow
Hughes, Walter 1C Barrow
Jones, Evan.... 1C Cardiff
Jones, Frank S. 2C Cardiff
Kilburn, C. S. . 2C Glasgow
Littlejohns, Alb. 2C Cardiff
Lyle, Duncan .. 2C London
M'Iver, John .. 1C Glasgow
Morrison, James 1C Leith
Newbegin, Geo A D 1C W. Hart'l
Nichols, F. J. .. 2C N Shields
Nivison, T. C. . 1C South'ton
Ord, David W. 2C N. Shields
Paisley, F. T... 2C Liverpool
Pepler, Saml G. 1C Cardiff
Pescoed, R. E. . 1C N Shields
Philp, David .. 2C South'ton
Piggford, A. F. 2C N. Shields
Pollock, D. S... 1C London
Robertson, J. D. 2C Glasgow
Russell, Wm. D 1C Glasgow
Seagrave, Wm Sellers, Harold 2C W. Hart'l
Scott, Isaac M. 2C N. Shields
Spoor, Ralph H. 2C N Shields
Stephens, E. R. 2C South'ton
Stewart, Thos. . 1C N. Shields
Thomas, Wm 1C Liverpool
Thomson, J. W. 1C London
Threlfall, H. C. 1C Liverpool
Todd, Geo. H. . 1C W. Hart'l
Towers, Jas. W. 1C Cardiff
Tsoupas, Mich. 2C Leith
Twigg, Thos. R. 2C London
Urquhart, Allan M'P. 1C W Hart'l
Vile, Henry N. 2C London
Warren, W. H. 2C W Hart'l
Whyte, Thomas 2C South'ton

June 1st.

Anderson, Wm. 2C Aberdeen
Baker-Gabb, D. A. 2C Greenock
Black, Joseph .. 1C Aberdeen
Brady, Thos. .. 1C London
Byles, Thomas 2C London
Dale, Thomas.. 1C Hull
Davison, Francis 2C Sunderl'd
Doig, William.. 2C Aberdeen
Downes, Owen 1C Liverpool
Edgecombe, Wm. J. 2C Sunderl'd
Fielder, James 1C London
Fitzgerald, Percy 1C Liverpool
Gleed, Albert S. 2C Bristol
Harris, Hy. C. . 2C Hull
Inglis, John R. . 1C Aberdeen
Inskup, Jos. B 2C Liverpool
Islip, Thos. K. . 2C Bristol
Jones, John .... 2C Bristol
M'Allister, Peter 2C Greenock
M'Gregor, C. E. 1C London
M'Lean, John.. 1C Greenock
M'Pherson, J.D. 2C Aberdeen
Macdonald, A.H 2C Greenock
Matheson, Kenneth J. W. 2C Aberdeen
May, Harold W. 1C Liverpool
Morrison, Wm. 2C Greenock
Mowat, William 1C Aberdeen
Owen, Owen G. 2C Liverpool
Patrick, John .. 1C Greenock
Prosser, J. A. B. 2C London
Reith, John W 1C Aberdeen
Rigg, John ..... 2C Greenock
Robson, Wm. J. 1C Bristol
Rose, Stephen . 1C Sunderl'd
Runaman, John 2C Liverpool
Sharp, Arch. H. 1C Liverpool
Skene, William 2C Aberdeen
Sleigh, Edw. M. 2C Liverpool
Smith, James .. 2C Greenock
Stableford, Wm Storey, John D. 1C Sunderl'd
Strike, H G .. 1C Bristol
Thornton, F. W. 2C Bristol
Webster, J. S. . 2C Hull
Westbrook, T. . 2C Liverpool
Wright, C W. . 1C Sunderl'd
Willey, Edward 1C Sunderl'd

June 8th

Armston, John 2C N Shields
Atherton, J. H. 2C Liverpool
Barrowman, Geo. E. M. 2C London
Beatson, John.. 2C Glasgow
Boler, Rich. F. 1C Liverpool
Braidwood, W. 1C Glasgow
Brodie, John V. 2C Glasgow
Buchanan, Jas 1C Glasgow
Bullock, Robert 2C Belfast
Bulman, George 1C N Shields
Campbell, A. P. 2C Belfast
Campbell, Thos. 2C Liverpool
Clark, Robert .. 2C Glasgow
Daniels, L. S... 2C N. Shields
Davies, Jenan .. Dilley, Geo. S. . 1C Glasgow
Dixon, Charles . 2C London
Edmonds, W. J. 1C South'ton
Evans, D H. 2C Cardiff
Ferguson, John 1C Liverpool
Gibbons, W. G. 2C South'ton
Hall, Thos. M. 2C N. Shields
Hemmings, Wm M 1C N. Shields
Howe, Robt. W. 2C N Shields
Hutchinson, W. 1C N. Shields
Imrie, John.... 1C Liverpool
Inglis, Francis . 2C London
Legg, Robt. H. 1C N. Shields
Lemon, R H 2C London
Linton, Jas. H. 2C Cardiff
MacDonald, R. 2C Glasgow
MacLean, R. .. 2C Glasgow
Masterton, G. I. McGillivray, J. 1C Glasgow
McLean, J.McL. 1C Glasgow
Meyer, Oscar .. 1C N. Shields
Pendleton, Wm. 2C Liverpool
Powell, W H. 1C Liverpool
Quayle, John .. 1C Liverpool
Roberts, Ernest 1C South'ton
Salmon, Ernest 2C N. Shields
Staines, Saml. S. 2C London
Stewart, James 2C Glasgow
Sutherland, W. 2C Glasgow
Wood, Henry E. 2C Glasgow
Young, Geo A. 1C Glasgow

June 15th.

Bathgate, Arth. 2C N Shields
Bowden, R P .1C Liverpool
Buchan, Robert 2C Glasgow
Clackrie, J. C. 2C Liverpool
Cochrane, R. S. 2C Greenock
Davies, Frank.. 1C Liverpool
Drummond, T.P. 2C N Shields
Ebdon, Harry . 2C N. Shields
Esmond, E. G. 1C London
Forsyth, John.. 2C Liverpool
Hayes, Fred. C. 1C Liverpool
Howell, William 1C London
Jones, William 1C Liverpool
M'Donald, J. G. 2C London
Miller, William 2C Greenock
Plastow, Ed. C. 1C Hull
Roberts, Tom P. 1C London
Robinson, W H 1C N. Shields
Ross, Matt. J... 2C N Shields
Scholefield, W. 2C N. Shields
Shepherd, Jas. . 1C Hull
Stephenson, H 1C N. Shields
Suddards, G. H. 2C N Shields
Whyte, Alf. W. 2C Dundee
Wren, Thos G. 1C London
Wooster, C K 1C London

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